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[OFFICIAL NOTICE.]

Detroit Meeting, American Gas Institute.

HEADQUARTERS, AMERICAN GAS INSTITUTE,
25 West 39th street, New York, Aug. 20, 1909.

The following preliminary outline of the plans underway for the Detroit meeting of the American Gas Institute may be of interest. The Committee of Arrangements, as appointed by President Prichard, was made up as follows: Irvin Butterworth, Chairman; J. T. Lynn, J. J. Knight, B. O. Tippy, W. T. Barbour, W. S. Blauvelt.

With the approval of the President, Mr. Butterworth has added to the list a number of men prominent in the gas industry. The Sub-Committees are now arranged as follows:

Ways and Means Committee.—James T. Lynn, Chairman; W. T. Barbour, Geo. H. Barbour, James W. Dwyer, John J. Knight, Frank Hulswit, Lazard Kahn, D. J. Collins, J. N. Williamson.

Smoker.—Jules G. Hoffman, Chairman; Alonzo P. Ewing, A. L. Zwisler, F. P. Mueller, Ed. Leaky.

Boat Trip.—V. F. Dewey, Chairman; W. S. Blauvelt, Jas. Foley, Roy Shacklette.

Entertainment of Ladies.—H. L. Olds, Chairman; W. G. Henry, W. R. Vanvalkenburg, Andrew H. Green, Jr., Samuel T. Douglas, W. E. Moss, B. O. Tippy, Stanhope Boal, W. C. Kennedy, George D. Roper, George M. Clark, Charles H. Dickey, A. T. Knowlson

Hotels, Hall and Information.—E. F. Lloyd, Chairman; George Osius, Edward M. Mabcourt, G. O. Ciliax.

The Committee has decided to arrange for an informal "Smoker" at the Wayne Pavilion, instead of a banquet. There will be a theater party, luncheon at the Country Club and trips about the city for the ladies. A steamboat trip to Lake St. Clair, down the river to Bois Blanc, including an inspection of the very interesting engineering work at the new channel, and a visit to the Solvay Process plant, will be features. The headquarters will be at the Pontchartrain, and the meetings will be held at Elks' Hall, only a block distant.

Mr. R. B. Brown, Chairman of the Technical Committee, advises that about 16 papers are being prepared, and that Dr. Hyde has consented to give a lecture on "Illuminating Engineering."

There will be three good papers on commercial sujects, one on "Accounting," one on "Illuminating Engineering in Practical Applications," and a first-class technical and general programme.

The reports from the "Wrinkle Department," "Bureau of Information," and the various committees, will contain matter of unusual interest. Further details, as to hotel accommodations and papers, will be sent out soon.

A. B. BEADLE, Secretary.

[OFFICIAL NOTICE.]

Eighteenth Annual Meeting, Michigan Gas Association.

OFFICE OF THE SECRETARY,
GAS OFFICE BUILDING,
DETROIT, MICH., August 11, 1909.

To the Members of the Michigan Gas Association: All arrangements have been completed for the 18th Annual Meeting of the Michigan Gas Association, to be held aboard one of the large D. & C. boats, leaving Detroit, September 14th, at 9 A.M. The boat will comfortably accommodate 250. All reservations for staterooms must be made promptly in order to secure accommodations. The tickets, including the berth, all meals, in fact, all expenses from the time the boat leaves Detroit until its return, are $22 each; $3 extra if a stateroom is to be reserved for one person.

This ticket includes the annual dinner and all entertainment features. The following programme has been arranged:

"How We Sold Our Surplus Coke," by Mr. Glenn R. Chamberlain, Secretary, Grand Rapids (Mich.) Gas Light Company.

"Study of Firebrick," by Mr. V. F. Dewey, Engineer, Detroit City (Mich.) Gas Company.

An informal talk by Mr. H. M. Wilson, Chief Engineer of the Technologic Branch, U. S. Geological Survey, Washington, D. C., whose "talk" will be on the "Purchase of Coal."

"Retort Benches," by Mr. A. S. B. Little, Engineer, St. Louis, Mo.

"Illuminating Engineering Problems with Gas," by Mr. Norman Macbeth, Manager of Illuminating Engineering Laboratories, Welsbach Company, Gloucester, N. J.

The sessions have been so arranged that it will give you ample opportunity to see the beautiful scenery of the St. Clair river, the beautiful scenery of the St. Mary's river, and 3 or 4 hours will be reserved at the Soo for inspection of the locks. There will be 3 or 4 hours on Mackinac Island.

Staterooms may be reserved any time prior to September 1st by the deposit of $10.

Any reservations not made prior to September 1st must be made on board the boat the morning of the 14th of September.

Circular, giving full information, may be had by applying to A. P. Ewing, Secretary, Gas Office Building, Detroit, Mich.

Very truly yours,
ALONZO P. EWING,
Secretary and Treasurer.

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[NOTICE.]

Experience Division, Pacific Coast Gas Association.

PACIFIC COAST GAS ASSOCIATION,
OFFICE, EDITOR OF EXPERIENCE DIVISION,
LOS ANGELES, CAL., August, 1909.

To the Members, Pacific Coast Gas Association:

"Gas Bag:" "Why is the Experience Department Like a Divorce Scandal?"
"Leaky Pipe:" "Give It Up."
"Gas Bag:" "The Experience Department relates to painful Experiences, but a divorce scandal is a painful experience to relatives."

Be that as it may, what the Experience Department hath brought together let no man tear asunder. Every year we have our sanctified, purified and illuminating union; and it is a union of affinities. Two hearts may beat as one; but no man can beat experience as a teacher. What, then, can so efficaciously teach the gas man as this wedding of Experiences, chaperoned, purified and solemnized by the Editor of the Experience Department? Preparations for the ceremony are now underway, and we need your assistance. Send in your experiences. Speed them along. Brook no delay. Almost any old thing is eligible, and no family names are betrayed. Fall in line: The wedding march is sounding. Fraternally yours, R. P. VALENTINE, Editor.

[NOTICE.]

Wrinkle Department, American Gas Institute.

WRINKLE DEPARTMENT, AMERICAN GAS INSTITUTE,
OFFICE OF EDITOR, GAS OFFICE BUILDING,
DETROIT MICH, March 12th, 1909.

To the Members, American Gas Institute: All members of the American Gas Institute are earnestly requested to forward contributions for the Wrinkle Department as soon as possible.

Your co-operation determines the success of the Department.

F. L. CROSS, Editor.

BRIEFLY TOLD.

CURRENT MENTION.—

His many friends will sympathize with Mr. James S. McIlhenny, Engineer-in-Chief, Washington (D. C.) Gas Light Co., over the death of his estimable wife, who passed away the morning of the 25th inst., after an illness of lengthy duration. During all that time of pain and weakness she manifested to fullest measure those qualities that are shown by the brave, and whose bravery and resignation are based on the knowledge that God's will shall be done.

THE movement to install and operate a gas plant in Corpus Christi, Tex., is well underway. Strange-to-say, the Council seems disposed to treat the projectors with favor rather than repression.

"V. R. C.," is informed that Mr. George L. Dunbar has been appointed Manager of the gas plants at Auburn, Garrett and Kendall, Ind.

THE Interurban Electric Company, to maintain gas and electric lighting and heating plants in Carterville, Ills., has been incorporated by Messrs. F. W. Richart, H. B. Cassell and F. E. Denison. It is capitalized in $150,000.

"P. B. R.," writing from Fort Wayne, Ind., under date of the 25th inst., says: "Dear JOURNAL—I failed to see in your columns any mention of the death of big-hearted, whole-souled, cheery-voiced 'Charlie' Knight, whose fame 20 years ago, as a gas and electric light man, was world-wide. Naturally his fame should have been great, for he was one of the first—if not the first—to advocate the conjoint control of gas and electric lighting plants. In view of his prominence in the trade, backed by the knowledge that he was one of God's noblemen, I think some mention of his booking for the long journey should be made in your columns, for, to the knowledge of the writer, 'Charlie' frequently had a good word to say for the JOURNAL and its staff, which good words were frequently spoken out in meeting during the transition decade of 1880-1890. Charles Stewart Knight, who died at his home on Spy Run avenue, Fort Wayne, Ind., the evening of August 14th, was born in Columbus, O., November 24, 1846. In early life he entered the service of the Panhandle Railroad, making his home in Logansport, Ind., in 1868. In 1881 he was appointed Manager of the Fort Wayne Gas Company, and later on (in 1886) became associated with Mr. R. T. McDonald in the operation of the Fort Wayne Electric Company, which speedily became one of the largest electric manufacturing concerns in the West. Later on he was elected to the Vice-Presidency of the Company, with general charge of its selling division, and it was in the latter capacity that he made his succeeding business mark. In 1898, or when the Fort Wayne concern was absorbed by other larger electrical concerns, Mr. Knight removed to Chicago, to represent the Siemens-Halske Company, of Germany. This he did with success and profit until that representation was also taken over by the electrical syndicate. In 1901, Mr. Knight devoted his attention mainly to engineering enterprise; with good success, too. He is survived by his widow, four daughters and two sons. He was high in Masonic circles, having gone through the 32d degree, and had an especial interest in the Fort Wayne Lodge, B.P.O.E. He was a member of the First Presbyterian Church of this city. Of him it may be truly written, in his death is ended the life of one who 'Did unto others as he wished to be done by.'"

THE Queensboro Gas and Electric Company has contracted with the Western Gas Construction Company for the erection of a 10-foot 6-inch water gas set, to go in on the plant at Rockaway Beach, Long Island. It is arranged that the set will be equipped with the Kerr type of turbo blower apparatus. Superintendent Eckhart seems to be a pretty good man to have at a works, for although he has been there not over a twelvemonth he has had the satisfaction of seeing the sendout for 24 hours go to 1¼ millions cubic feet.

"AT a special election, held last Monday, the electors of Beatrice, South Beatrice and West Beatrice, Neb., by a big majority, voted to extend the franchise of the Gage County Gas Light and Power Company (successor to the Beatrice Gas and Power Company) for a period of 25 years. One of the results of the election will be the immediate extension of the main system to suburbs that have not heretofore had gas. The Company has been serving gas for 2 years, and in that period it has developed an output in excess of 3 millions cubic feet per month, and it is now engaged in conducting an energetic and very successful business campaign under the direction of Mr. D. F. Johnson. The Company is a unit in the properties owned here by certain Cleveland (O.) interests that are being capably directed by Mr. C. S. Eaton.—P."

IN the general shifting which naturally followed the acquiring of the Mount Clemens (Mich.) Gas Company by the Dawes-Kelsey syndicate, we have pleasure in noting that not only were the services of Mr. Emory P. Davis retained, but that in addition he was promoted to the post of Manager. Mr. Hugo Waltzer also retains the dual task of cashier and bookkeeper.

THE distributing system for the new plant at Gadsden, Ala., the the moving spirit in which enterprise is Mr. H. C. Higgins, of Centralia, Ills., will be completed by late this fall. The initial mapping calls for the placing of 6 miles of mains.

WE are more than glad to say that Mr. Austin Burt, Superintendent of the Citizens Gas and Electric Company, of Waterloo, Ia., is convalescing from the severe attack of rheumatism that beset him this summer.

"SAN JOSE, CAL., August 18th, 1909.—Things do come easy to some men, seemingly at any rate; and why it appears so to me just now is the way the boys of the United Gas and Electric Company handed it out to their newly appointed Manager, Mr. J. D. Kuster. Arriving in town right at the close of the week, a committee the following Sunday waited on him at his hotel, at an appropriate hour. There were, I think, 14 of us, 'and 1 of him,' so he did not have much chance (or reason, either) for declining to go out and take a seat in a roomy vehicle which in due time, and good time, deported the party to Paul Masson's picturesque Mountain Ranch, known as 'Ferncliffe,' and which nestles in the most picturesque spot in the world-famed Saratoga hills, that are surely fitting background adornment to the beautiful valley in San Jose. The grand drive whetted (I was quite a while getting to that word whetted) our appetites, and his too; and what do you suppose *Chef* George W. Ballard, the Company's Manager, had arranged for us? Well, if I must tell, 'twas a barbecue, and never was finer one served, even close to 'ole Virginny shore.' Oh, maybe it didn't touch the spot!—T. S. M."

THE Galesburg (Ills.) Railway and Light Company has awarded a contract for three arches and two fillings of full-depth benches of 9's, to the Gas Bench Construction Company, of St. Louis, Mo. Mr. T. Y. Beard, in charge of the distribution division, is extending the piping system, and General Superintendent McAfee certainly may be counted a busy man, charged with the work of making many improvements to all divisions of the Company's plant—gas, electric and street railway. The Company completed a good negotiation when it secured Mr. McAfee's signature to the contract that binds them.

MR. J. SCOTT HARRISON, of Kansas City, Mo., has been chosen Treasurer of the Merion and Radnor (Pa.) Gas and Electric Company, vice Mr. R. F. Williams.

MR. E. L. STURTEVANT has been elected Secretary of the Springfield (Ills) Gas Light Company.

Four Times the Light for One-Half the Money.

[Communicated by Mr. E. H. Yorke, Portland, Me.]

For the past year our slogan has been "Four times the light for half the money;" and in order to prove that contention was founded on fact, I fitted up two booths, each of which was equipped identically alike, with fixtures and glassware. However, in one booth were electric lights of different illuminating values, and in the other were varying types of Welsbach lights. Then I had these lights photographed, reproductions of which photographs are here given.

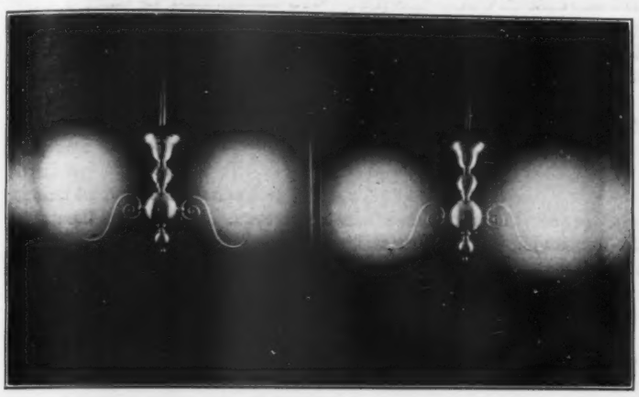


Fig. 1.

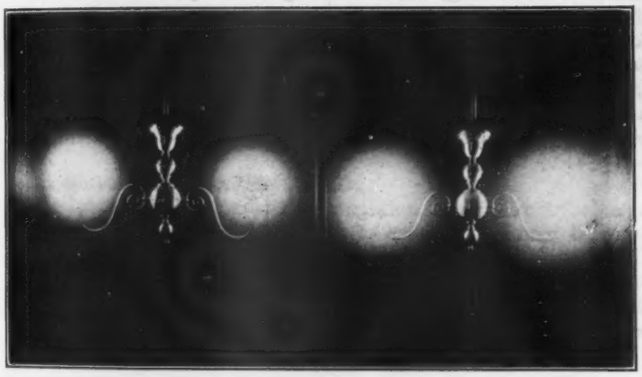


Fig. 2.

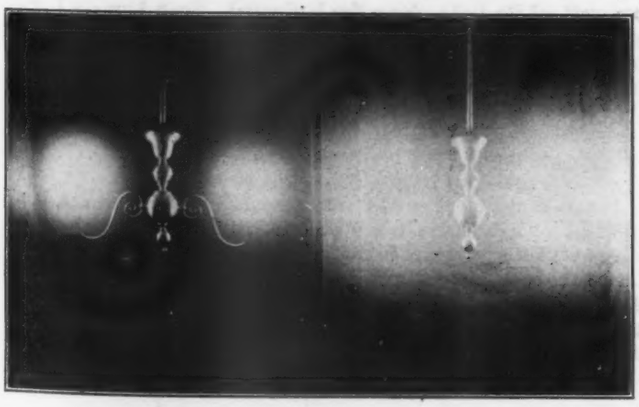


Fig. 3.

These cuts show the difference in volumes of light so plainly that I am constrained to believe the reproductions thereof would be of exceeding interest to the gas fraternity at large, wherefore I forward them to you for publication in the Journal.

As the cost of gas and electricity varies in each city, I have omitted any comparison on that basis; but it will be a simple matter for any gas manager to figure the thing out for his home location.

Key to the Photographs.

No. 1.....	Two 16-c.p. electric.	Two	Welsbach Junior gas lights.
No. 2.....	Two 32-c.p. "	Two	" " " "
No. 3.. ...	Two 16-c.p. "	Two	" Socket " "
No. 4.....	Two 32-c.p. "	Two	" " " "
No. 5.....	Two 60-watt tungsten.	Two	" " " "

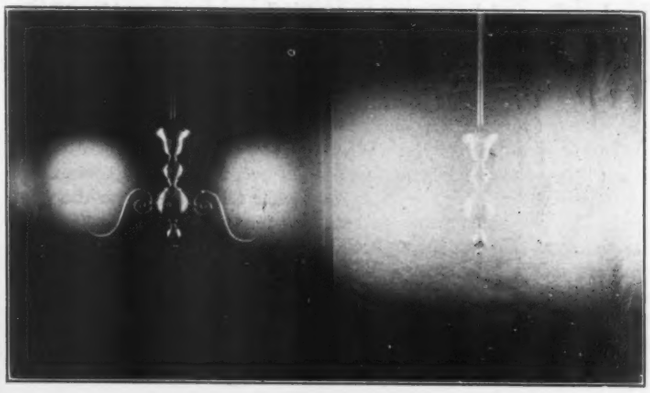


Fig. 4.

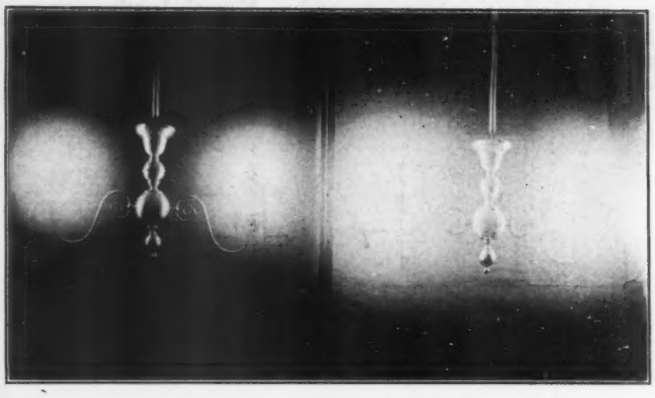


Fig. 5.

60-watt tungsten costs per hour..... $\frac{4^0}{100}$ cts.	Welsbach socket costs per hour..... $\frac{4^5}{100}$ cts.
Electricity, 10 cts. per kw.	Gas $1.25 per 1,000 cubic feet.

The Chronic Fault-Finder.

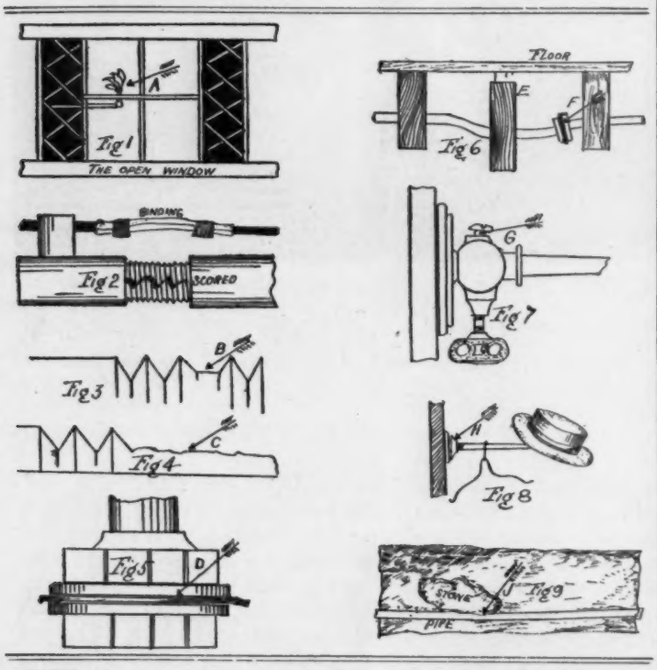
[Communicated by Inspector.]

Just why so many consumers of gas complain about their bills is always a knotty problem to gas men. There are, of course, chronic kickers in all professions, as is known. The wholesaler and the retailer of merchandise must put up with more or less complaining on the part of his customers. In fact, everyone seems to have a kick coming. Gas manufacturers and distributers have long since become hardened to the ways of chronic kickers; but instead of getting angered, the gas men seek to pacify and humor. It is a truth that the experienced gas man merely smiles when he is abused by a patron whose meter has been running too fast, and if he is busy with his accounts the awful calling down he receives does not disturb him to the extent of making him figure incorrectly. The diplomat in the gas office can write and calculate even while a noisy patron is cursing. This is because he allows things to come in one ear and pass out of the other. Perhaps he will listen long enough to make an explanation to the person who is raving in front of the wicker window and perhaps he will not, for after you have been abused several times a day by inconsiderate persons around paytime, you get rather used to it and do not mind it. However, it is a good plan to give the complainer a calling down once in a while. In one case the lady of the house gave an exhibition of her temper in the office while she waved a bill for gas which seemed to her to be about 75 cents too much. That is, the accounting of the swift little meter estimated 75 cents worth more gas than the previous month. The meter was examined, tested in the usual way, and found to be correct.

The lady explained that she had burned the lights no longer than usual. In looking for a leak we located a jet near a window, and the condition was as shown in Fig. 1. The window was kept open all the time, and the draft at *A* swept the flame. Consequently the lady was obliged to let the cock stay full open in order to get enough gas to supply the flame. Formerly the gas was ample in supply with the cock partly open. The jet was turned around to clear the draft, and the next month the gas bill fell back to its proper figure. In

another case the gas pipe running beneath the floor was found next a water pipe. The water pipe in freezing had burst, and water that collected about the gas pipe froze thereupon. Warping resulted and a leak developed through a split in the pipe. The householder attempted to bind up the leak from the outside, with slabs of thin wood, as in Fig. 2. The leakage continued and ran up the bill and the party was furious when he appeared at the office. He condemned the company in great style. We had to tear up the floor of the house to put in a new piece of pipe, and he refused to pay the expense. In another instance which is told, the kicker tried a trick on the company. He bought a meter and studied up the method of estimating the register. He cut through the pipes, had the meter connected in next the company's meter. When he found that the thing did not assist him any in catching the gas company, he had the meter taken out and used a plug for the connection, as in Fig. 2. The plug was scored along the threads and leakage and odors resulted. Of course, the man kicked to the company. Rather than have trouble with the man, the company simply repaired the leak.

It would be a good lesson to certain consumers if their gas supply was cut off when they became too tricky. Nevertheless there are real causes for complaints now and then. Pipes need watching, like the meters. Recently a house was filled with gas odors, due to the breaking off of some threads on a pipe. If but one thread is stripped, as at *B*, Fig. 3, no harm can follow, as a rule, because the remaining



threads hold the joint tightly; but if a number of threads are stripped off, as in Fig. 4 at *C*, the gases have an opportunity to gradually work along the thread plan and escape. In the case in mind the gas odors were traced to the stripped threads of pipe. There are reasonable people who complain only when the occasion requires it, and there are careless men in the employ of all gas companies, all of which should be taken into consideration. In other words, the kicker may be in the right once in a while. Therefore, we should be willing to hear his story and make an investigation. In fact, most of the gas distributers do this. I always wonder how the clerks can be so patient. A party complained of his bill running too high. An examination revealed that a union had been made very carelessly with a gasket of hard leather, like at *D*, Fig. 5, between the flanges. Red lead had been used, but the union was not tightened up enough to assure a close fit. This was due entirely to carelessness. Of course, the thing leaked. It so happened that the escaping fumes passed outside and no one noticed the odor; but the master of the house noticed the increased proportions of his gas bill.

Then there are cases in which settling floors cause leaks and high gas bills. One lady complained several times, but still her bills ran up, and no one could detect anything wrong with the meter. Finally it was noticed that a weighty piano caused the floor to settle. An investigation showed the condition exhibited in Fig. 6, in which a floor beam *E* settled, carrying with it the gas pipe. The wrenching on the pipe caused it to draw downward and open a joint, as at *F*. A leak was made and the meter ticked merrily along while no gas jets were burning.

It is strange how some people will monkey with the little screw, *G*, on top of the cock of a gas jet. If the cock turns hard they will use kerosene oil and sometimes lard. They will loosen the screw with a pair of scissors or a knife blade and spoil the slot. They will strike the parts with a hammer if the cock turns hard. Dirt gathers and ought to be removed. Many leaks can be traced to the fact that the little screw is not in place.

Then, again, it is found that some people produce leaks in the gas fixtures by using the fixtures as hooks for hats and clothes. I recollect one case in which the party was accustomed to hang a heavy garment over a wire frame supported to the gas fixture, as in Fig. 8. This resulted in a severe strain on the fixture at *H*, and a leak was soon created.

There is always an annoyance when the leaks are developed under ground. Lately a case arose in which the workmen in filling in a trench permitted a large stone to fall upon the unprotected gas main. A fracture was made at *J*, Fig. 9. But the workmen filled in the place just the same. It was weeks afterwards before the fact that the pipe leaked at this juncture was discovered. Meanwhile the man of the house visited the office twice to distribute pleasing remarks all about.

Inverted Incandescent Gas Lights.

Mr. Henry O'Connor (according to the *Gas World*), at the Dublin meeting of the Irish Association of Gas Managers, which was held in the named city the second week in August, lectured on the subject named in the heading. In introducing his subject the lecturer said that this type of burner was, in its operation, the reverse of scientific, for gas, being lighter than air, tended to rise, and flames burned upwards, yet in this burner we reversed the laws of nature. But we got the result required by this means, namely, the maximum of light in a downward direction. Of recent years there had been a tendency to increase the amount of light for all purposes, and this was, no doubt, owing to the cheapening of the lighting agent through the introduction of the Welsbach mantle. This, however, had been accompanied by a desire to clothe the ceilings with papers having more or less pronounced patterns, in place of the older method of whitewashing. These papers would absorb, in many cases, as much as 40 or 50 per cent. of the light thrown upon them, which was a complete loss to the general illumination of the room, as, with a newly whitewashed ceiling, 80 or 90 per cent. of the light thrown upon it was reflected in various directions, and the heavy shadows were thus removed, and a softer and more even lighting secured. This was specially advantageous with the upright burner, which radiated as much as 50 per per cent. of its light above the horizontal. Such burners, in fact, gave their maximum effect in a horizontal direction, and, therefore, we required to reflect this, if we wished the light for reading or working purposes, for which light was usually required below the level of the burner. Hence the walls must also be of a light color. Orange colored paper reflected only 55 per cent., green 10 to 46 per cent., pale red 16 per cent., and brown 15 per cent., while deep chocolate would reflect only 4 per cent. of the light thrown upon it.

Aesthetics might demand "dirty greens" and dull colors, but if we wanted "light, more light," we must keep to pale and light colors. The next matter in regard to reflection to be considered was the globe. One of the best for transferring the horizontal rays to the vertical was the "Holophane" globe, manufactured on the prismatic principle, after the type of lighthouse lenses. These globes effectively spread the light in the downward direction, but were necessarily rather expensive to manufacture, and had gradually fallen somewhat out of favor. The advent of the inverted burner also rendered them less advantageous. But there were many of the opal globes in use which did not reflect the light in the best direction. The ordinary opal globe, with the clear glass at the lower part, had its sides too steep; they should be at 45° with the horizon, and not 60 or 70°, as usual. The light would be then directed downwards through the clear glass portion, instead of outwards, where the opal portion of the globe obstructed their direct radiation.

The inverted burner, in contradistinction to the upright, gave 76 per cent. of its light below the horizontal, its maximum being at about 30° below it, while directly underneath there was some 80 per cent. of the maximum light radiated in any one direction. This was, of course, rendered possible by the mantle being fully exposed in that direction, without the interposition of any par f the burner. This

led to the placing of all or most of the burner over the flame, and in many cases resulted in the obtaining of a lesser quantity of light than might be possible from the gas consumed.

Air Supply.—To get the best effect from the burning of a gas of any composition, a definite quantity of oxygen was required, and to find out the quantity of air required to insure complete combustion, they must know the percentage of H, CH_4, and CO in the gas. With a coal gas having a composition of, say, H 53 per cent., CH_4 37 per cent. and CO 5 per cent., and taking 100 cubic feet as the quantity of gas to be used, we should require 103 cubic feet of oxygen, or 490 cubic feet of air, equal to 4.9 cubic feet of air for each cubic foot of gas. For a carburetted water gas containing H 35.6 per cent., CH_4 17 per cent. and CO 28 per cent., we should require 65.8 cubic feet of oxygen, or 313 cubic feet of air, equal to 3.13 cubic feet of air for the complete combustion of 1 cubic foot of the gas. The 4.9 cubic feet of air would consist of 1.03 cubic feet of oxygen and 3.87 cubic feet of nitrogen, and the 3.13 cubic feet of air of 0.66 cubic foot of oxygen and 2.47 cubic feet of nitrogen, and this nitrogen had a cooling effect upon the flame, as it was heated and passed away, carrying off heat which might otherwise be used to give heat to the mantle. If the air was still further weakened by the addition to it of carbon dioxide and water vapor, the proportion of oxygen was still further reduced, and the flame was cooled to a greater extent. This happened with many of the inverted burners now on the market, as the products of combustion, which were principally nitrogen, carbon dioxide and water vapor, passed up round the air holes of the Bunsen burner, where some 3½ volumes of air were required to mix with the gas to get the best effect. Consequently, if the air was contaminated, a lesser quantity of oxygen was mixed with the gas in the primary combustion, and the green inner cone (which was to be seen when the proper proportion was obtained, and which gave a maximum heat of some 3,220° F.) was absent, and a lilac inner cone only was found, when the maximum temperature was probably only some 3,080° F.

The light given by a mantle was increased by a rise in the temperature of the flame to a much greater extent than was represented by the increase of heat, only a small percentage increase in heat giving a large percentage of increased light. This was obtained by making the flame smaller for a given consumption of gas; and, despite this reduction of size, the intense flame, when fitted with the proper size of mantle, gave a greater amount of light. It could not be too often repeated that when complete combustion occurred, only a given quantity of heat could be evolved from a given quantity of gas, whether Bunsen, flat flame, high pressure or blow-pipe flame, was used, and the size of the flame varied inversely as the intensity, so that the greater the intensity of the flame the smaller it was. With increases of pressure of air and gas there was practically no limit to the heat obtainable by a gas flame, hence the very high duty of 60 candles per cubic foot which was obtained by the Keith high pressure burners, where the gas was compressed to about 54 inches of water, or nearly 2 pounds per square inch.

Gas and Air Regulation.—No inverted incandescent gas burner was complete without regulators for both air and gas, so that the flame could be adjusted to exactly fit the mantle and keep the filaments in the hottest part of it, which was the outer envelope, where the carbon monoxide was combining with the oxygen of the air. Otherwise the mantle must be the exact size of the flame, which latter would vary with the pressure and quality of the gas and was consequently difficult to fit. The gas regulator required to be as near as possible to the outlet of the gas in the Bunsen burner, so that the full pressure of the gas was available to cause the inrush of air, the ordinary tap only serving to reduce the quantity of pressure and thus reducing the injecting effect. The regulation should be capable of delicate adjustment, and the air passages designed to allow of easy travel for the air, so that there would be no stoppage of flow, and the intake should be below the outlet for the products of combustion. With such precautions it should not be difficult, and, in fact, had been proved to be possible, to obtain as high a duty as 39 to 41 candles per cubic foot of gas consumed. The greatest fault with most of the regulators on the market was that the cone did not occupy the exact center of the hole through which the gas issued, so that the air induced with the gas was not evenly mixed with it, and the heat of the mantle was not even throughout. The difficulty which the maker of the regulator experienced was that the heat was playing on it while in use, and, consequently, when the regulation had to be changed, if the regulator was delicately fashioned, it was fixed and could not be moved.

Many people thought that the larger the mantle the greater the light. This was not necessarily the case, and with many burners the larger mantle reduced the candle power. He had had burners submitted to him to test with extra large mantles, and had obtained only about 15 candles per cubic foot with them, whereas with the same burner and a smaller mantle he had obtained as much as 39 candles per cubic foot of gas consumed.

The best light was obtained when the air and gas were regulated to give a violent ebullition or popping when starting, but this would cease in about 5 minutes, when the burner was heated up and the slight excess of air (which caused the noise) had been reduced, owing to the heating of all the parts of the burner.

There was no doubt that the exposure of the mantle to the oxygen of the air deteriorated it, as did also dampness, so that it was important to know, when purchasing, that the mantles had been recently made and that the old stock was not being palmed off on them.

Street Lighting and Reflectors.—In view of the frequent employment of inverted incandescent burners for street lighting, some remarks regarding their use in this connection might not be out of place. There was no doubt that an even illumination over the whole surface of the road was what was most desirable. They wanted this light, not to read a newspaper laid flat on the road surface, but to enable them to see any obstructions. Hence the fact that light varied as the cosine to the normal of the ray of light did not, in his opinion, enter into the question.

If we consider that our lamps are fixed 60 yards apart, and are 10 feet high, we shall find that the angle at which the greatest light is required is 6.36° below the horizontal, so that the most light may be shed in the direction of the road, midway between the two lamps. Dealing, then, with the direct light only from the burner, which would be shed on a surface normal to the ray, and neglecting, for the reason above stated, the light on the surface of the road, we have a comparative distance of 90½ feet to the point midway between the lamps, as against 10 feet from the lamp to the ground, immediately under the light, or a difference of illumination of 82 to 1. If we desire a direct light from each lamp of 1/40 candle foot, making in all 1/20 candle foot as the light from both sources, we shall require each of the burners to give 205 candle power at 6.36° below the horizontal, and, in a vertical direction only, 5-candle power.

Now it is quite evident that our burners cannot give this light without some alteration of the light at present sent from an inverted incandescent burner, which is, roughly, equal at all degrees below the horizontal, but which is slightly greater at about 30° below. A concave reflector which would serve to direct all the light radiated from a burner about 5 below the horizontal would have to be of such a shape that, if we try to use this light, we shall have a number of reflected reflections, each with its loss of power (because no reflecting surface will give out all the light shed upon it), as the edge of the domed surface, on the opposite side, will obstruct the direct reflection in the required direction. Consequently, we must forego some of the more horizontal rays to utilize a greater number of these at higher angles; but even then we cannot get much benefit from these rays.

Then, again, for the light in a direct downward direction, we may use some of this to reflect outwards, to come somewhat nearer the required light at the point midway between the lamps. At first sight, it would appear that a reflector of a curved cone pattern would best serve the purpose, placed on the bottom of the lamp, but a further examination will show us that the point of the cone will come too near the mantle and be effected by its heat, so that some other form will have to be adopted.

To utilize the rays in both the upward and downward directions, which are not needed if we desire an even illumination of the area, I have designed a reflector by which the light rays under the lamp and up to below the horizontal are made to pass through the opal reflector, and are consequently reduced, while the proportion which is reflected is used to increase the light projected about the angle 6.36° below the horizontal, where the most light is required. The reflector has been designed of a true conical form, so as to spread the light somewhat about the spot referred to, but the central rays are in the required direction. The cost of such reflectors is not great, and would tend to a more equal illumination of the area between the lamps than is possible without such aids.

Mr. O'Connor, in conclusion, explained that the blackening of ceilings was not due to burning gas, but to the condensation of moisture from dust-laden air by the cool walls and ceiling of the room, and pointed out that the same blackening occurred where steam heated radiators were employed.

The President proposed a vote of thanks to Mr. O'Connor for his exceedingly interesting lecture. [Seconded by Mr. Shadbolt and unanimously carried.]

United States Corporation Tax Law, as Per the Statutes of 1909.

SECTION 38.—That every corporation, joint stock company or association, organized for profit and having a capital stock represented by shares, and every insurance company, now or hereafter organized under the laws of the United States or of any State or Territory of the United States or under the Acts of Congress applicable to Alaska or the District of Columbia, or now or hereafter organized under the laws of any foreign country and engaged in business in any State or Territory of the United States or in Alaska or in the District of Columbia, shall be subject to pay annually a special excise tax with respect to the carrying on or doing business by such corporation, joint stock company or association, or insurance company, equivalent to 1 per centum upon the entire net income over and above $5,000 received by it from all sources during such year, exclusive of amounts received by it as dividends upon stock of other corporations, joint stock companies or associations, or insurance companies, subject to the tax hereby imposed; or if organized under the laws of any foreign country, upon the amount of net income over and above $5,000 received by it from business transacted and capital invested within the United States and its Territories, Alaska, and the District of Columbia during such year, exclusive of amounts so received by it as dividends upon stock of other corporations, joint stock companies or associations, or insurance companies, subject to the tax hereby imposed: *Provided, however*, That nothing in this section contained shall apply to labor, agricultural or horticultural organizations, or to fraternal beneficiary societies, orders, or associations operating under the lodge system, and providing for the payment of life, sick, accident, and other benefits to the members of such societies, orders, or associations, and dependents of such members, nor to domestic building and loan associations, organized and operated exclusively for the mutual benefit of their members, nor to any corporation or association organized and operated exclusively for religious, charitable, or educational purposes, no part of the net income of which inures to the benefit of any private stockholder or individual.

Second.—Such net income shall be ascertained by deducting from the gross amount of the income of such corporation, joint stock company or association, or insurance company, received within the year from all sources; (first), all the ordinary and necessary expenses actually paid within the year out of income in the maintenance and operation of its business and properties, including all charges such as rentals or franchise payments, required to be made as a condition to the continued use or possession of property; (second), all losses actually sustained within the year and not compensated by insurance or otherwise, including a reasonable allowance for depreciation of property, if any, and in the case of insurance companies the sums other than dividends, paid within the year on policy and annuity contracts and the net addition, if any, required by law to be made within the year to reserve funds; (third), interest actually paid within the year on its bonded or other indebtedness to an amount of such bonded and other indebtedness not exceeding the paid-up capital stock of such corporation, joint stock company or association, or insurance company, outstanding at the close of the year, and in the case of a bank, banking association or trust company, all interest actually paid by it within the year on deposits; (fourth), all sums paid by it within the year for taxes imposed under the authority of the United States or any State or Territory thereof, or imposed by the government of any foreign country as a condition to carrying on business therein; (fifth), all amounts received by it within the year as dividends upon stock of other corporations, joint stock companies or associations, or insurance companies, subject to the tax hereby imposed: *Provided*, That in the case of a corporation, joint stock company or association, or insurance company, organized under the laws of a foreign country, such net income shall be ascertained by deducting from the gross amount of its income received within the year from business transacted and capital invested within the United States and any of its Territories, Alaska, and the District of Columbia: (first), all the ordinary and necessary expenses actually paid within the year out of earnings in the maintenance and operation of its business and property within the United States and its Territories, Alaska, and the District of Columbia, including all charges such as rentals or franchise payments required to be made as a condition to the continued use or possession of property; (second), all losses actually sustained within the year in business conducted by it within the United States or its Territories, Alaska, or the District of Columbia not compensated by insurance or otherwise, including a reasonable allowance for depreciation of property, if any, and in the case of insurance companies the sums other than dividends, paid within the year on policy and annuity contracts and the net addition, if any, required by law to be made within the year to reserve funds; (third), interest actually paid within the year on its bonded or other indebtedness to an amount of such bonded and other indebtedness not exceeding the proportion of its paid-up capital stock outstanding at the close of the year which the gross amount of its income for the year from business transacted and capital invested within the United States and any of its Territories, Alaska, and the District of Columbia, bears to the gross amount of its income derived from all sources within and without the United States; (fourth), the sums paid by it within the year for taxes imposed under the authority of the United States or of any State or Territory thereof; (fifth), all amounts received by it within the year as dividends upon stock of other corporations, joint stock companies or associations, and insurance companies, subject to the tax hereby imposed. In the case of assessment insurance companies the actual deposit of sums with State or Territorial officers, pursuant to law, as additions to guaranty or reserve funds shall be treated as being payments required by law to reserve funds.

Third.—There shall be deducted from the amount of the net income of each of such corporations, joint stock companies or associations, or insurance companies, ascertained as provided in the foregoing paragraphs of this section, the sum of $5,000, and said tax shall be computed upon the remainder of said net income of such corporation, joint stock company or association, or insurance company, for the year ending December 31st, 1909, and for each calendar year thereafter; and on or before the first day of March, 1910, and the first day of March in each year thereafter, a true and accurate return under oath or affirmation of its president, vice-president, or other principal officer, and its treasurer or assistant treasurer, shall be made by each of the corporations, joint stock companies or associations, and insurance companies, subject to the tax imposed by this section, to the collector of internal revenue for the district in which such corporation, joint stock company or association, or insurance company, has its principal place of business, or, in the case of a corporation, joint stock company or association or insurance company, organized under the laws of a foreign country, in the place where its principal business is carried on within the United States, in such form as the Commissioner of Internal Revenue, with the approval of the Secretary of the Treasury, shall prescribe, setting forth; (first), the total amount of the paid-up capital stock of such corporation, joint stock company or association, or insurance company, outstanding at the close of the year; (second), the total amount of the bonded and other indebtedness of such corporation, joint stock company or association, or insurance company at the close of the year; (third), the gross amount of the income of such corporation, joint stock company or association, or insurance company, received during such year from all sources, and if organized under the laws of a foreign country the gross amount of its income received within the year from business transacted and capital invested within the United States and any of its Territories, Alaska, and the District of Columbia; also the amount received by such corporation, joint stock company or association, or insurance company, within the year by way of dividends upon stock of other corporations, joint stock companies or associations, or insurance companies, subject to the tax imposed by this section; (fourth), the total amount of all the ordinary and necessary expenses actually paid out of earnings in the maintenance and operation of the business and properties of such corporation, joint stock company or association, or insurance company, within the year, stating separately all charges such as rentals or franchise payments required to be made as a condition to the continued use or possession of property, and if organized under the laws of a foreign country the amount so paid in the maintenance and operation of its business within the United States and its Territories, Alaska, and the District of Columbia; (fifth), that total amount of all losses actually sustained during the year and not compensated by insurance or otherwise, stating separately any amounts allowed for depreciation of property, and in the case of insurance companies the sums other than dividends, paid within the year on policy and annuity contracts and the net addition, if any, required by law to be made within the year to reserve funds; and in the case of a corporation, joint stock company or association, or insurance company, organized under the laws of a foreign country, all losses actually sustained by it during the year in business conducted by it within the United States or its Territories, Alaska, and the District of Columbia, not compensated by insurance or otherwise, stating separately any amounts allowed for depreciation of property, and

in the case of insurance companies the sums other than dividends, paid within the year on policy and annuity contracts and the net addition, if any, required by law to be made within the year to reserve fund; (sixth), the amount of interest actually paid within the year on its bonded or other indebtedness to an amount of such bonded and other indebtedness not exceeding the paid-up capital stock of such corporation, joint stock company or association, or insurance company, outstanding at the close of the year, and in the case of a bank, banking association or trust company, stating separately all interest paid by it within the year on deposits; or in case of a corporation, joint stock company or association, or insurance company, organized under the laws of a foreign country, interest so paid on its bonded or other indebtedness to an amount of such bonded and other indebtedness not exceeding the proportion of its paid-up capital stock outstanding at the close of the year, which the gross amount of its income for the year from businees transacted and capital invested within the United States and any of its Territories, Alaska, and the District of Columbia, bears to the gross amount of its income derived from all sources within and without the United States; (seventh), the amount paid by it within the year for taxes imposed under the authority of the United States or any State or Territory thereof, and separately the amount so paid by it for taxes imposed by the government of any foreign country as a condition to carrying on business therein; (eighth), the net income of such corporation, joint stock company or association, or insurance company, after making the deductions in this section authorized. All such returns shall as received be transmitted forthwith by the collector to the Commissioner of Internal Revenue.

Fourth.—Whenever evidence shall be produced before the Commissioner of Internal Revenue which in the opinion of the Commissioner justifies the belief that the return made by any corporation, joint stock company or association, or insurance company, is incorrect, or whenever any collector shall report to the Commissioner of Internal Revenue that any corporation, joint stock company or association, or insurance company, has failed to make a return as required by law, the Commissioner of Internal Revenue may require from the corporation, joint stock company or association, or insurance company making such returns, such further information with reference to its capital, income, losses and expenditures as he may deem expedient; and the Commissioner of Internal Revenue, for the purpose of ascertaining the correctness of such return or for the purpose of making a return where none has been made, is hereby authorized, by any regularly appointed revenue agent specially designated by him for that purpose, to examine any books and papers bearing upon the matters required to be included in the return of such corporation, joint stock company or association, or insurance company, and to require the attendance of any officer or employee of such corporation, joint stock company or association, or insurance company, and to take his testimony with reference to the matter required by law to be included in such return, with power to administer oaths to such person or persons; and the Commissioner of Internal Revenue may also invoke the aid of any court of the United States having jurisdiction to require the attendance of such officers or employees and the production of such books and papers. Upon the information so acquired the Commissioner of Internal Revenue may amend any return or make a return where none has been made. All proceedings taken by the Commissioner of Internal Revenue under the provisions of this section shall be subject to the approval of the Secretary of the Treasury.

Fifth.—All returns shall be retained by the Commissioner of Internal Revenue, who shall make assessments thereon; and in case of any return made with false or fraudulent intent, he shall add 100 per centum of such tax, and in case of a refusal or neglect to make a return or to verify the same as aforesaid he shall add 50 per centum of such tax. In case of neglect occasioned by the sickness or absence of an officer of such corporation, joint stock company or association, or insurance company, required to make such return, or for other sufficient reason, the collector may allow such further time for making and delivering such return as he may deem necessary, not exceeding 30 days. The amount so added to the tax shall be collected at the same time and in the same manner as the tax originally assessed unless the refusal, neglect, or falsity is discovered after the date for payment of said taxes, in which case the amount so added shall be paid by the delinquent corporation, joint stock company or association, or insurance company, immediately upon notice given by the collector. All assessments shall be made and the several corporations, joint stock companies or associations, or insurance companies, shall be notified of the amount for which they are respectively liable on or before the first day of June of each successive year, and said assessments shall be paid on or before the 30th day of June, except in cases of refusal or neglect to make such return, and in cases of false or fraudulent returns, in which cases the Commissioner of Internal Revenue shall, upon the discovery thereof, at any time within 3 years after said return is due, make a return upon information obtained as above provided for, and the assessment made by the Commissioner of Internal Revenue thereon shall be paid by such corporation, joint stock company or association, or insurance company immediately upon notification of the amount of such assessment; and to any sum or sums due and unpaid after the 30th day of June in any year, and for 10 days after notice and demand thereof by the collector, there shall be added the sum of 5 per centum on the amount of tax unpaid and interest at the rate of 1 per centum per month upon said tax from the time the same becomes due.

Sixth.—When the assessment shall be made, as provided in this section, the returns, together with any corrections thereof which may have been made by the Commissioner, shall be filed in the office of the Commissioner of Internal Revenue and shall constitute public records and be open to inspection as such.

Seventh.—It shall be unlawful for any collector, deputy collector, agent, clerk, or other officer or employee of the United States to divulge or make known in any manner whatever not provided by law to any person any information obtained by him in the discharge of his official duty, or to divulge or make known in any manner not provided by law any document received, evidence taken, or report made under this section except upon the special direction of the President; and any offense against the foregoing provision shall be a misdemeanor and be punished by a fine not exceeding $1,000, or by imprisonment not exceeding 1 year, or both, at the discretion of the court.

Eighth.—If any of the corporations, joint stock companies or associations, or insurance companies, aforesaid, shall refuse or neglect to make a return at the time or times hereinbefore specified in each year, or shall render a false or fraudulent return, such corporation, joint stock company or association, or insurance company, shall be liable to a penalty of not less than $1,000 and not exceeding $10,000.

Any person authorized by law to make, render, sign, or verify any return who makes any false or fraudulent return, or statement, with intent to defeat or evade the assessment required by this section to be made, shall be guilty of a misdemeanor, and shall be fined not exceeding $1,000 or be imprisoned not exceeding 1 year, or both, at the discretion of the court, with the costs of prosecution.

All laws relating to the collection, remission, and refund of internal revenue taxes, so far as applicable to and not inconsistent with the provisions of this section, are hereby extended and make applicable to the tax imposed by this section.

Jurisdiction is hereby conferred upon the circuit and district courts of the United States for the district within which any person summoned under this section to appear to testify or to produce books, as aforesaid, shall reside, to compel such attendance, production of books and testimony by appropriate process.

[Continued from Page 534.]

The Comparative Values of Various Coatings and Coverings for the Prevention of Soil and Electrolytic Corrosion of Iron Pipe.

[A paper prepared by MR. ROBERT B. HARPER, for the Illinois Gas Association.]

Description of Solutions.—The various solutions and soils into which the porosity and resistance samples were placed were selected with a view of subjecting the coatings to the action of as many different kinds of conditions, corrosive or otherwise, as they would be likely to encounter in actual service.

Distilled water, containing practically no mineral solids and probably only a small amount of oxygen, nitrogen, carbon dioxide and other gaseous constituents, was used in order to ascertain roughly what coatings were or were not naturally permeable to water. Distilled water, saturated with the constituents of carburetted water gas, was employed to determine the effect of such upon preservative compounds.

In order to find the effect of water containing small amounts of mineral and organic matter, Lake Michigan water was used. This water, according to a test made at the city laboratory, had been recently analyzed as follows:

	Grains per Gallon.	Per Cent.
Silica (SiO_2).....	0.467	.0008
Iron and alumina ($Fe_2O_3+Al_2O_3$)	0.093	.0002
Calcium carbonate ($CaCO_3$).....	4.077	.0070
Calcium sulphate ($CaSO_4$).....	0.332	.0006
Magnesium carbonate ($MgCO_3$) .	2.265	.0039
Sodium sulphate (Na_2SO_4	trace	trace
Potassium sulphate (K_2SO_4).....	trace	trace
Sodium chloride (NaCl).....	0.340	.0006
Undetermined..... ...	0.251	.0004
	7.825	.0135

Clay and cinder soils used in the electrolysis test have already been described, and mention need only be made here of the fact that these soils were saturated with about 5 times their own weight of water. The loam soil, which was used only in the porosity and resistance tests, was a rich, black, sandy loam, containing about .0476 per cent. of soluble mineral salts and .0580 per cent. of organic and volatile compounds.

The dilute sulphuric acid (H_2SO_4) used in this test contained 10 per cent. by weight of the acid. This solution, which was used as sulphuric acid, is probably one of the most common free acids, barring carbonic, which we find in soil waters. Rain waters in large manufacthring cities have been found to contain from .002 to .008 per cent. of sulphuric acid extracted from the atmosphere. It may be derived from other sources, and during electrolysis it tends to accumulate and concentrate at the anode.

In order to determine the general effect of a base, a dilute solution containing 10 per cent. of dissolved ammonia (NH_3) was used to test the coatings and coverings. Ammonium hydrate (NH_4OH) was selected as a base because it is perhaps one of those most frequently found in soil waters. It exists in relatively large amounts in waters containing sewage or decomposing organic matter. Free ammonia in sewage may vary from .001 to .05 per cent.

For the purpose of observing the effect of oxidizing influences upon protective materials, the samples were immersed in a solution containing 1 per cent. by weight of hydrogen peroxide. Strong brine, consisting of a solution containing 10 per cent. by weight of sodium chloride (NaCl) was used as a bath in which to immerse samples of pipe covering, so that the general effects of strong salt solution might be determined and compared with those obtained by other experimentalists.

Method of Testing.—The samples, which included coated sheet iron pieces, cloth and paper specimens, were placed, one at a time, between the moistened disks of the porosimeter and the resistance in ohms of the section between the metal plates, carefully determined by means of the telephone, and checked with the galvanometer attachment of the Whitney ohmmeter, shown in Fig. 12.

Each sample, after testing, was immersed to a depth of 3 inches in some solution, taken out after a time, all visible surface moisture carefully removed, and the approximate resistance of a circular section of 1 square inch determined between the disks, which had been moistened with some of the same solution previously surrounding the test specimen.

Only sufficient solution was applied by means of a camel's hair brush to give a thin film or complete contact between each disk and the adjacent surface of the coated sample. All tests were made with clean disks, at the same temperature, namely, 70° F., and completed as rapidly as possible, in order to avoid errors resulting from possible polarization or heating effect.

Between the determinations of resistance the samples were strung on a heavy wire passing through small holes near the tops, so that an area of 3 by 3 inches on each side of the covered portion of each specimen was immersed in water contained in rectangular glass dishes 8 by 4 by 4 inches. The samples, from and to which electrical currents were made to flow, under a pressure of about 1.5 volts, were strung on a heavy glass rod passing through small holes near the tops, in much the same manner as the others. The latter samples, however, were placed with their surfaces ½ inch apart, and were separately attached by wires to binding posts, which were connected alternately to the positive and negative terminals of the Edison cells, arranged to give approximately 1.5 volts potential difference between samples connected to binding posts of opposite polarity.

Object of the Volatility and Oxidation Tests.—The object of the volatility and oxidation tests was to determine, as far as possible, to what extent various coatings and coverings were subject to physical or chemical rearrangements of particles due to the volatilization or oxidation of one or more of the constituents.

Description of Apparatus.—The apparatus used in the volatility and oxidation tests consisted only of weighed and numbered clean glass slides, each 1 inch wide and 3 inches long, provided with a small hole at one end, by which they could be hung on hooks.

Theory of Testing.—The volatility and oxidation tests were founded upon the assumption that those coatings or coverings which showed considerable variations in weight, for some time after their application to an article, were likely to be rather doubtful preventatives of corrosion, due to the belief that the continued volatilization or oxidation of the constituents required an uninterrupted, more or less ineffectual readjustment of the particles.

A preservative compound which gradually decreased in weight was thought to be on the average less efficient than some other so-called preventative of corrosion, which slowly increased or remained practically constant in weight, because the general tendency would be to form voids in the first case and to either close them up or furnish no increase in their number in the latter cases.

Method of Testing.—The dry, clean and numbered glass slides were weighed carefully, then covered on their lowered portions with various protective materials in films of thicknesses similar to those on the metal samples in the porosity and resistance tests. The glass samples were weighed immediately after the application of the coatings or coverings, then hung in a room where the temperature was practically constant at 70° F. From time-to time the samples were carefully reweighed and note made of any increases or decreases in weight.

These tests extended over a period of time sufficient to show the nature and extent of the general changes due to the volatilization and oxidation of the constituents of the various protective compounds.

Miscellaneous Tests.

Many other tests of a variegated character, and of perhaps minor importance, were made in connection with the determination of the comparative values of various coatings and coverings for the prevention of soil and electrolytic corrosion of iron pipe, but time and space forbid their description in this paper.

A complete chemical analysis was not made of each preservative material, owing to the fact that such a procedure required more time than was available, and that, although a complete analysis would be of undoubted value, yet its importance as data from which deductions might be made, as to the relative merit of a coating, would not be commensurate with that of other tests. Only the results of these minor tests will be introduced at the proper time, if the data referred to shall be deemed of sufficient moment as worthy of consideration.

Description of Coatings and Coverings Tested.—There are so many preparations used, and methods employed, to protect underground metallic structures from destruction by soil or electrolytic corrosion, that it was impossible for the writer to cover the entire field in his tests. However, an endeavor has been made to investigate the merits of as many different types and makes of so-called protective coatings or coverings as time would permit. In some cases, it was not possible to subject the material to all of the tests, owing to the fact that it was submitted too late for a complete examination. Nevertheless, a large number of preventatives of corrosion present themselves for description; included are preparations and wrappings now being employed by various gas and water companies for preserving their underground pipes, numerous compounds which are now on the market as insulating and anti-corrosive paints, dips, etc., various mixtures which have been submitted or suggested as being of possible value in preventing soil or electrolytic corrosion; and, finally, for the purpose of comparison, certain coatings and coverings not necessarily designed or usually employed for the protection of metallic pipes subject to soil or electrolytic corrosion.

General Description of Preservative Compounds.

Cremo.—Cremo is a modification of the well-known Hickenlooper coating now used by many gas companies for the protection of their service pipes. It is made in the following manner:

A 50-gallon barrel of clean, water-free, coal tar is placed in an ordinary portable tar kettle and gradually heated up by a slow fire. When sufficiently fluid, 25 pounds of freshly slaked lime are sifted over the top and well stirred into the tar, which is now brought to a boil. When the mixture shows a consistency of a soft pitch upon cooling a sample to ordinary temperature, the fire is drawn and the whole allowed to cool somewhat. The maximum temperature of the

mixture when the fires are drawn is usually 500° F. The hot pitch is transferred to settling and cooling tanks. As the mixture cools to about 350° F., 3 pounds of powdered resin and about 8 pounds of tal low are added and worked in until well dissolved and incorporated with the pitch. When a temperature of about 200° F. is reached, 5 gallons of rubber cement (containing rubber and turpentine in the ratio of 4 pounds of pure rubber to 7 gallons of turpentine) are added and stirred in until a thoroughly homogeneous mixture results.

Cremo, when fresh, is a brownish-black, soft material that possesses tenacity, and, when stretched by pulling apart two surfaces to which it is attached, presents a fibrous or ropy appearance. Even when made with the greatest care, it contains particles of rubber which appear as minute lumps. It has a specific gravity of from 1.2 to 1.25 and often contains over 3 per cent. by weight of lime. It becomes fluid at about 180° F.

Cremo remains soft for a considerable time, but gradually hardens, apparently by volatilization and oxidation of some of its constituents.

Annapolis Mixture.—Annapolis mixture was first tried, with great success, on old, leaky, tin roofs as a waterproofing. A. C. Cunningham[1] claims it is the only mixture that will unquestionably stick and thoroughly cover galvanized iron. Annapolis mixture consists of 16 parts by volume of coal tar, 4 parts by volume of Portland cement, and 3 parts by volume of kerosene oil. This mixture, which is black and fluid when fresh, requires frequent stirring when not in use, as the cement and kerosene both tend to separate from the tar. When painted on an article, it dries slowly, but finally gives a dry, hard, though rough coat. The specific gravity of the Annapolis mixture used in the tests was 1.515.

Dr. Angus Smith's Mixture.—The formula for the tar varnish, originally applied by Dr. Angus Smith in 1840, is not definitely known, but the mixture bearing his name and used in these tests was made according to the following receipt, which seems representative of his kind of coating:

"Distil coal tar until the light oils are removed, the tar deodorized, and the resulting mixture has the consistency of molasses or a very soft pitch. When cool, add 6 per cent. of raw linseed oil and thoroughly stir same into the pitch until the whole is homogeneous."

Dr. Angus Smith's mixture, as made by the writer, was a soft, black, pitch-like material, having a specific gravity of about 1.20. When heated highly, the linseed oil in the Smith compound separates from the pitch. It becomes fluid at about 140° F. Hardening takes place slowly.

Red Lead Paint.—Red lead has long been considered one of the best pigments which could be used with linseed oil in making a protective paint for iron or steel. Red lead is believed to combine chemically with raw linseed oil, or to "set," as it is often termed.

As it is one of the best protective pigments for iron, the writer mixed and thoroughly ground together previous to use, pure red lead and raw linseed oil, in the ratio of 18 pounds of the pigment to 5 pounds of the oil, according to a receipt[2] for 1 gallon of a red lead paint which has given the best results in a test.

The red lead paint, as made, had a specific gravity of about 2.75 and covered iron surfaces well. It ceases to be tacky in from 24 to 48 hours, but requires a longer time before becoming thoroughly dry.

Sarco Pipe, Dip No. 15.—Sarco pipe, dip No. 15 is manufactured by the Standard Asphalt and Rubber Company. It is a black compound, having the characteristics of elasticity and malleability. This coating material is said to be "The successful solution of the problem of electrolysis."

Sarco pipe dip probably consists mainly of bitumens, such as asphaltine and petroline. An analysis of this material, made by Mr. A. D. Meeds,[3] City Chemist of Minneapolis, is as follows:

	Per Cent.
Petroline (soluble in petroleum ether)	75.71
Asphaltine (soluble in boiling turpentine and chloroform)	23.59
Total bitumen	99.30
Coke and organic matter not bitumen	0.49
Ash (mineral matter)	0.21
Moisture and volatile matter at 100° C	0.00
	100.00
Specific gravity	0.97

It has a specific gravity slightly less than that of water, being .990 according to the sample submitted. Sarco pipe dip contained only .35 per cent. ash. When heated, it reached a point of fluidity at about 300° F. This coating apparently hardened by cooling, and when cold, had a dull black appearance.

Concrete.—The concrete material was used for comparative purposes only, as it has been both favored and condemned as a protector of ferric structures. The concrete used consisted of equal parts by weight of the Marquette brand of Portland cement and of torpedo sand passing a 10-mesh sieve, thoroughly mixed with 15 per cent (by weight of dry mixture) of water. This covering was tamped into place, allowing to set in a moist atmosphere and then dried out under ordinary atmospheric conditions before testing. It was a very compact and hard concrete with a minimum of voids present.

Ebonite.—Ebonite is a black, quick-drying paint, manufactured by the National Insulite Company, of Aurora, Ills. It is said to be manufactured from pure elaterite, which is put into solution by a secret process. It is a quick-drying paint, in which the volatile oil resembles naphtha. The sample submitted bore a label proclaiming the following: "A new paint by a new process. Preserves all metals. Chemical, electric, alkali, water, acid proof." Ebonite has a specific gravity of about .80.

Carbonkote No. 1.—Carbonkote No. 1 is a thick paint, manufactured by the Nubian Paint and Varnish Company, for preserving steel and iron surfaces. It consists chiefly of elaterite and a Chinese wood, with linseed oil vehicle. Carbonkote No. 1 gives a film of paint which loses its tackiness after drying for about 24 hours. When dry this paint gives a film having the properties of great elasticity and toughness.

The sample submitted has a specific gravity of .895 and contained .46 per cent. ash.

Crysolite.—Crysolite is a black paint, manufactured by the Semet-Solvay Company. It is recommended for use upon roofs, bridges, piping, submerged work, etc. This paint consists apparently of a coal tar base, presumably a good pitch, dissolved in light oils resembling benzol, which form a mixture having a specific gravity of about 1.10. It dries somewhat slowly, but eventually gives a comparatively hard surface. The sample tested was practically free from mineral matter, as the ash amounted to only .23 per cent.

Voltax No. 105.—Voltax No. 105 is a thick, varnish-like liquid, having a specific gravity of .966. It is an insulating varnish of clear, amber color, manufcatured by the Electric Cable Co., but not especially recommended as a preventative of electrolysis. It probably consists of one or more resins, gums or other insulative compounds, dissolved in volatile or oxidizable oils.

Acid Fume-Proof Paint.—Acid fume-proof paint is a black paint resembling coal tar. It is manufactured by the G. & B. Paint Co. This paint is said to consist mainly of an asphaltic base, obtained from Texas crude oil, mixed with mineral oil and finely ground mica. It is quite thick and has a specific gravity of 1.118. It dries slowly, but eventually hardens.

Depew No. 1.—Depew No. 1 is a comparatively thin, black paint, manufactured by the Depew Carbon Paint Co. It is recommended as being proof against heat, frost, weather, ammonia, acids and electrolysis. It is claimed that there is no asphaltum or tar in this paint, which is practically free from mineral matter. The paint tested gave a specific gravity of .797. It was a very quick drying paint, giving in ½ hour a glossy finish and an elastic film without tackiness.

Mogul Electrical Compound.—Mogul electrical compound is a thick, black paint, manufactured by A. Grothwell. It is a quick-drying paint which, according to sample tested, has a specific gravity of .992. It dries with a black, glossy finish, and is not tacky. It contains practically no mineral matter. It is claimed to be a waterproof preservative for insulators, conduits, cables, etc.

Mogul Repairing Compound.—Mogul repairing compound is a paint somewhat thicker than Mogul electrical compound. It shows a specific gravity of .910. This paint gives a coating which has a tendency to be somewhat brittle, although it displays evidences of tackiness for a considerable time after application. It, like the Mogul electrical compound, may be termed a quick-drying paint. It is recommended for use with cloth for leaks in roofs, gutters, etc.

Carbonkote No. 100.—Carbonkote No 100 is a graphite paint manufactured by the Nubian Paint & Varnish Co. It is a paint containing finely divided graphite ground in oil, which probably contains linseed and drying or volatile oils. This paint was not submitted as a preventative of electrolysis, but was tested for purposes of comparison only.

Ohmlac No. 1.—Ohml c No 1 s experimental paint made from

1. "Engineering News," Vol. LVI., July 12, 190[illegible].
2. "Transactions," Amer. Soc. Mech. Engrs., 18[illegible]-94, p. 10[illegible]8.
"Engineering News;" Vol. XLIII., p. 392.

one part by weight of Ohmlac K4, manufactured by the Ohmlac Mfg. Co., to two parts by weight of turpentine. The solution, made by gentle heating of the mixture, gave a thick, black paint; specific gravity, .940; drying in from 26 to 48 hours. This paint gives a film with very slight tackiness and a glossy finish.

Tar Coating Mixture.—Tar coating mixture is a protective material used by the Consolidated Gas, Electric Light and Power Company, of Baltimore. The receipt used is as follows:

10 gallons of coal tar.
18 gallons of oil tar.
7 quarts turpentine and crude rubber mixture.
5 pounds dissolved tallow.
1¼ pounds of resin.

Note.—Crude rubber mixture consists of 2 pounds rubber dissolved in 7 gallons pure turpentine; heat mixture enough to get ingredients thoroughly mixed. Used cold on street or field work. The mixture, made up according to the foregoing formula, was sufficiently thin to apply cold by brush. The specific gravity was 1.146. This mixture gives a thin film, but does not seem to harden, even after several months from the time of application.

Sarco Cold Field Coating.—Sarco cold field coating is a thick paint manufactured by the Standard Asphalt and Rubber Company. The sample submitted had a specific gravity of about .885. This paint gives a black, glossy film, which dried very slowly, and retains the property of tackiness for months. It gives a film somewhat thicker than the average paint.

Sarco Railroad Special Coating.—Sarco railroad special coating is somewhat similar to the Sarco cold field coating. If has a specific gravity of .880. It dries quicker than the Sarco cold field coating, and gives a glossy black film which is not tacky.

Ohmlac, K-35.—Ohmlac, K-35 is a product of the Ohmlac Manufacturing Company. The sample tested was a black, pitch-like substance, said to consist mainly of elaterite. It was inclined to be somewhat brittle, even at ordinary temperatures. The specific gravity of the substance was about 1.27 and the protective material became fluid at 275° F. Ohmlac, K-35, when used as a dip, and applied to a metallic iron surface, gives a black, hard, glossy film which is somewhat brittle.

Black Monarch Dip.—Black monarch dip is an experimental coating made by Eugene Arnstein. It is said to consist of a pseudo-gum in a solid solvent, and is colored with a black mineral hydrocarbon. This material has a specific gravity of 1.015 and a melting point of about 230° F. It is inclined to be somewhat brittle. Black monarch is purely an experimental coating for which no claims are made. It gives a hard, black, glossy coating, not subject to any great degree of tackiness.

Red Monarch Dip.—Red monarch is, like black monarch dip, an experimental coating. It is said to contain the same constituents as the preceding coating, with the exception that the black mineral hydrocarbon is replaced by ferric oxide. Red monarch is a chocolate brown material, more or less clear. It is slightly heavier than the black monarch, having a specific gravity of 1.038. It becomes readily fluid at 270° F., but is inclined to be quite brittle at 70° F. This dip does not give a very smooth coating, as it seems to contain many lumpy particles.

Cleefite.—Cleefite is an experimental protective material submitted by Eugene Arnstein, manufacturer of cements, etc. This material has a specific gravity of .917 and becomes fluid at about 290° F. It is said to consist of pseudo-gum, dissolved in a liquid solvent and a black mineral hydrocarbon. This compound is very sticky or tacky at ordinary temperatures. It gives a glossy coating containing a few small, lumpy particles.

Cremo Pitch.—Cremo pitch is that residuum obtained by heating water-free coal tar, with about 5 per cent. of its weight of powdered lime, to a temperature of about 500° F., or until the undistilled portion gives a soft pitch at ordinary temperatures. It is exactly similar to the pitch used with tallow, resin and rubber cement in making Cremo pipe coating. It has a specific gravity of 1.267 and a relatively high point of fluidity; namely, 260° F. However, it is very soft at lower temperatures.

Water Gas Tar Pitch.—Water gas tar pitch is made in exactly the same manner as Cremo pitch; that is, it is made by boiling carburetted water gas tar with 5 per cent. by weight of powdered lime, until the mixture reaches a temperature of 500° F. It is a more fluid or softer pitch than that just previously described. The specific gravity of the sample tested was 1,164, while the melting point was about 210° F.

Cremo No. 2.—Cremo No. 2 was submitted to test mainly for the purpose of obtaining a somewhat comparative value of water gas pitch as a substitute for the coal tar pitch base used in Cremo. This preparation is made in a similar manner to Cremo (the first coating described) as regards quantities and procedure, with the exception that water gas tar is substituted for coal tar.

Cremo No. 2, as prepared, gave a thinner mixture than ordinary Cremo, and was lighter, having a specific gravity of 1.185. It also had a lower melting point, which approximated 140° F. This mixture covered metal with a black, glossy coating, which had the same general drying or hardening properties as the normal Cremo.

Resistance Pipe Coating.—Resistance pipe coating is an experimental compound submitted by the Nubian Paint and Varnish Company. This protective material is a black, waxy substance, said to contain a hard hydrocarbon gum, a sticky wax and a linseed oil compound. This mixture has a specific gravity of .993 and melts to an easy flowing liquid at 270° F. It contains only about .05 per cent. of mineral matter. Resistance pipe coating shows a tendency toward brittleness, even at an ordinary temperature of 70° F. It adheres to clean metal well and, when cold, presents a dull, waxy appearance.

St. Louis Mixture.—St. Louis mixture consists of 80 per cent. coal tar pitch and 20 per cent. coal tar and slacked lime; 1 quart of slacked lime to 1 gallon of coal tar. This material is similar to that used in St. Louis for coating service pipe. The mixture might be termed a thick, black paint, having a specific gravity of about 1.31. It spreads well over a warm metallic surface, gives a very glossy, black film, which is soft but not tacky, after drying for several weeks.

Cremo No. 3.—Cremo No. 3 is a coating similar to Cremo in all respects save one, or the rubber cement constituent, which does not enter into the composition of No. 3. This material is a soft, black pitch, resembling the original pitch base in appearance. It has a specific gravity of 1.260, and melts at about 200° F. Cremo No. 3 gives a smooth, black film.

Cremo No. 4.—Cremo No. 4 is, like the preceding, somewhat similar to Cremo. The only difference between the two is absence of the rubber cement and tallow constituents of ordinary Cremo in Cremo No. 4. The preparation is somewhat like Cremo No. 3, but has a higher specific gravity, namely, 1.264, and also melting point. Cremo No. 4 gives a comparatively hard coating.

Texaco.—Texaco is a black, bituminous compound manufactured by the Texas Company. It consists of the residuum obtained by the distillation at low heat of Texas asphaltic oil. It is said to consist of 99 per cent. bitumen. This pipe dip gave a specific gravity of .991 and became quite fluid at 331° F. Texaco gives a coating of a dull, black appearance.

Coal Tar Pitch, 600° F.—Coal tar pitch, 600° F., is that residuum obtained by heating pure coal tar at a rate of 3° per minute until a temperature of 600° F. is reached. This substance has a specific gravity of about 1.28 and becomes fluid at 150° F.

Coal Tar Pitch, 700° F.—Coal tar pitch, 700° F., is that product remaining after distilling off lighter compounds until coal tar reaches a temperature of 700° F. It has a specific gravity of about 1 29 and melts at about 250° F. This protective dip gives a hard, slightly brittle and very glossy coating to metallic surfaces.

Water Gas Tar Pitch, 700° F.—Water gas tar pitch, 700° F., is made in a manner similar that just described for the coal tar pitch. It has a specific gravity of 1.192 and melts to an easy-flowing liquid at 200° F. This pitch is much softer, thinner and lighter than the coal tar product obtained by the same method. It is quite brittle, despite its tendency to run.

Mineral Rubber Pipe Dip, 250° F.—Mineral rubber pipe dip, 250° F., is manufactured by the Standard Asphalt and Rubber Company. This material has a specific gravity of 1.01 and becomes fluid at 240° F. This coating material resembles Sarco pipe dip in many respects and is probably of practically the same constitution. It gives a semi-glossy covering.

California Refined Asphaltum.—California refined asphaltum, known as the Maltha brand, Special "D," obtained from the California Asphaltum Sales Agency, is a black, bituminous substance, showing a decided brittleness. It has a specific gravity of 1.045, and melts in the neighborhood of 200° F. California asphaltum gives a semi-glossy covering.

General Description of Wrapping Materials.

It has often been the practice of gas and water companies to use some wrapping material in conjunction with a paint or dip in form-

ing a protective covering for their underground pipes. The main object of this procedure has probably been a desire on their part to reduce to a minimum the danger of possible abrasions of the coating. Then, again, wrapping materials have doubtless been used in an attempt to hold the base on to the pipe, or to the insulative strength of the whole A number of wrapping materials were tried in an endeavor to determine their respective merits as agents in the protection of metallic structures against corrosion.

Buckskin Manila Paper.—Buckskin manila paper is a tough, strong, buff-colored paper, manufactured by Bradner, Smith & Co. It averages about .004 inch thickness, and about 50 square feet of this paper would weigh 1 pound. Buckskin manila paper, apparently, is sized, as it presents somewhat of a glazed appearance.

Muslin Cloth.—Muslin cloth is a thin, yet strong, coarsely woven fabric, about .01 inch in thickness. It consists of white cotton goods, which weighs 1 pound for every 37 square feet of cloth.

Tar Paper.—Tar paper of medium weight is manufactured by the Barrett Manufacturing Co. It is a good grade of tar paper, but does not work well as a wrapping material for iron pipes, owing to its thickness and tendency to tear and crack. This paper is .625 inch in thickness and is saturated with a coal tar product until there results a black, tarry paper, weighing 1 pound for every 10 square feet.

White Fiber Paper.—White fiber paper is a building paper manufactured by James C. Woodley & Co. It is apparently an unglazed paper, having a light buff color tinged with red. This paper has a thickness of .007 inch and 1 pound of it will cover 37 square feet. White fiber paper tears somewhat more readily than buckskin manila paper.

Black Fiber Paper.—Black fiber paper is a product of James C. Woodley & Co. It is very dark gray in color, and is a denser paper than the white fiber paper. This paper has a semi-glossy appearance, and looks as if it is sized or glazed. It is somewhat more tenacious than the white fiber paper. Black fiber paper is .005 inch in thickness, and 36 square feet of it weigh 1 pound.

Rubberized Felt.—Rubberized felt is a buff-colored material, quite flexible like cloth, and yet resembling a felt-like paper. The samples tested averaged about .008 inches in thickness. One pound of this rubber covers 2 square feet. This covering is exceedingly tenacious, and it is almost impossible to tear or pull it apart, as may be done with most papers or cloths.

(To be Continued.)

How Fuel Burns.

By Mr. M. O. Potts.[1]

There are so many people engaged in the heating business who have a very vague idea what is involved in the process of combustion, as evinced when they make such statements as "the oxygen in the air is burned," that some space devoted to the elementary considerations of fuel burning may not be out of place. While most of the information which the following account is designed to offer can be obtained in elementary text books relating to chemistry and the like, the writer must give credit to the Engineering Experiment Station at the University of Illinois for a somewhat complete monograph on the subject issued in Bulletin No. 15 published by the University on burning Illinois coal without smoke. The author of the bulletin is Prof. L. P. Breckenridge. The writer remembers that *The Metal Worker* has already noticed this bulletin in an editorial which referred to the fact that not only is smokiness a disagreeable factor with incomplete combustion, but invisible gases are given off that are of a deleterious character, inasmuch as they are the products of insufficient air supply, and include such gases as carbon monoxide, injurious and dangerous to the plant and animal life.

Combustion may be defined as a rapid chemical combination, resulting in heat and light. The combining elements are: (a) Oxygen, which is usually derived from atmospheric air; (b) either carbon or hydrogen, or a compound of the two. Sulphur sometimes appears with carbon and hydrogen, and also combines with oxygen. The substance that is formed by the chemical union is called the product of combustion; and the heat that is produced by the combustion of a unit weight (1 pound) of the fuel is called the heat of combustion. This is usually measured in British Thermal Units (B.T.U.). One B.T.U. is the amount of heat required to raise the temperature of 1 pound of water 1° F.

1. *Metal Worker.*

When hydrogen burns it combines with the oxygen of the air and forms water and gives off 62,000 heat units per pound of hydrogen burned. When carbon is burned one atom of carbon may take up one atom of oxygen, forming carbon monoxide and developing 4,400 B.T.U. per pound. When the combustion process is carried to its limit, in other words, when two atoms of oxygen combine with one atom of carbon, carbon dioxide is formed, developing 14,500 B.T.U. per pound of carbon. The difference in the amount of heat developed shows how important it is to have a sufficient draft and supply of air. When sulphur is burned sulphur dioxide is the result and develops 4,000 B.T.U. per pound of sulphur burned.

When 1 pound of hydrogen is burned it requires 8 pounds of oxygen and thus forms 9 pounds of water. In a similar way, when carbon monoxide is formed, for every pound of carbon burned 2⅓ pounds of the gas is developed. When carbon dioxide is formed 3⅔ pounds of the gas is developed for each pound of carbon burned; 2 pounds of sulphur dioxide result with the burning of 1 pound of sulphur.

Amount of Air Required.—When the oxygen needed for combustion is taken from the atmosphere, the nitrogen always present must be taken into consideration. Nitrogen takes no part in the combustion, but mingles with the products of combustion, absorbs heat from them and passes away with them. Approximately, it takes 4.25 pounds of air to furnish 1 pound of oxygen; the remaining 3.25 pounds are nitrogen. When the combustion of the different elements takes place in air the resulting relative weights are modified on account of the presence of the nitrogen. To burn 1 pound of carbon 11.33 pounds of air must be supplied. With the 3.67 pounds of carbon dioxide formed by the combustion, 8.66 pounds of nitrogen contained in the required weight of air passes up the chimney. Chemical combinations of carbon and hydrogen, the so-called hydrocarbons, play an important part in the burning of coal, particularly in those coals of large volatile content. The most important of these are the following:

Hydrocarbon Element.	Heat of Combustion. B.T.U.
Methane or marsh gas	24,020
Ethylene or olefiant gas	21,930
Acetylene	21,850

At the ordinary temperature and atmospheric pressure a pound of air has a volume of about 13.1 cubic feet. Using this value, the following round numbers are obtained for the theoretical amount of air required for the complete combustion of various fuels: 11.33 pounds or 150 cubic feet of air per pound of carbon; 34 pounds or 445 cubic feet of air for 1 pound of hydrogen; 4.25 pounds or 55 cubic feet of air for 1 pound of snlphur; 17 pounds or 220 cubic feet of air for 1 pound of marsh gas.

Temperatures Developed.—The heat developed by the combustion is absorbed by the products of combustion, and as a result the temperature of these gases rises in a marked degree. Thus when carbon is burned in air the 14,500 B.T.U. developed should heat the 3⅔ pounds of CO_2 and 8⅔ pounds of nitrogen from an initial temperature of, perhaps, 60°, to a calculated final temperature of about 4,500°. The actual final temperature, for reasons to be explained, is considerably lower. The products of combustion act as a vehicle, carrying the heat developed by combustion to its final destination.

It may, perhaps, be profitable to picture an ideal perfect combustion, and then inquire in what ways actual combustion falls short of the ideal. The given fuel, composed of carbon, various volatile hydrocarbon gases, and, perhaps, sulphur, is to be burned in air. Theoretically each atom of the fuel finds and seizes upon the number of oxygen atoms with which it will combine. Each atom will meet with two oxygen atoms at a temperature sufficiently high for ignition. They will combine, and the resulting carbon dioxide will pass out of the furnace, carrying with it the heat arising from the combustion; likewise with the hydrogen and sulphur atoms. No more air will be delivered than is just sufficient to furnish the exact number of oxygen atoms, and no carbon or hydrogen atoms will pass out of the furnace without finding oxygen atoms with which they can combine.

Excess of Air for Actual Conditions.—Actual combustion deviates from ideal conditions in many respects. If only the theoretical amount of air is supplied, on account of the difficulty of properly mingling the fuel and air, some of the fuel atoms will not find oxygen atoms and will escape uncombined. Or some of the carbon may burn to carbon monoxide instead of to carbon dioxide, and the carbon monoxide will escape without further combustion. It is found in

practice that to insure complete combustion an excess of air must be furnished. This excess is usually 50 per cent. and may reach 100 per cent.—*i. e.*, while only 11.3 pounds of air are required for the complete combustion of 1 pound of carbon, it is usually necessary to furnish 18 to 24 pounds. Since the heat of combustion is distributed throughout the excess of air introduced into the furnace, as well as the products of combustion, the furnace temperature is lowered by the presence of the extra air.

Avoid Sudden Cooling of Products of Combustion.—In another important particular, the actual state of affairs is likely to be quite different from the ideal combustion outlined above. Carbon and oxygen atoms will not unite unless a certain temperature, the ignition temperature, is reached. In parts of the furnace the temperature may fall below the ignition point because of the inrush of an excess of air, or because of cold bounding surfaces. As a result, carbon particles, even in the presence of plenty of oxygen, will refuse to burn. Let us further illustrate these principles by the use of some familiar examples.

If the reader understands why a torch smokes, why a flat wick is used in a lamp, why a circular burner is provided for the Argand or student lamp, why a chimney is provided for oil lamps, why a fish tail flame was used in early gas lighting, or why a vacuum bulb is provided for the incandescent lamp—if he understands these things, and most of us do, he will, it is believed, be able easily to see what conditions are necessary for perfect combustion in boiler furnaces.

If any fuel is to be burned without smoke it must be supplied with the correct amount of air. The torch smokes because the large round wick brings up oil, especially in the center, to which air cannot be supplied. If the air supply through the center tube of our student lamp is shut off a smoking flame results. The candle with the small wick is an advance over the candle supplied with the large wick. The flame from the flat wick has an extended surface for air supply, while the circular burner not only has maximum surface for air supply, but the air coming up through the center of the tube is heated, making it still better suited to aid combustion and burn a large amount of oil. Thus it is that we have successively solved the problem of burning a large oil supply without smoke. If we try to increase the oil consumption and turn up our lamps too high, they smoke, and because they are in the room with us we immediately turn them down. Furnaces burning coal sometimes smoke just because they are forced too hard and because the top of the chimney is not in our room, but in the public's pure air we do not turn them down, but let them smoke.

Air correct in amount is a necessity for complete combustion, and the simple experiments which we have all been making with our oil and gas flames should be sufficient evidence to us that only when we are able to supply our furnaces with the correct amount of air shall we be able to control the smoke which it is so easy to make. How much easier our problem would be if, as in the lamp, we could see all that was taking place and could regulate all by a simple knurled brass handle.

One Use of a Gas Stove.

In the August issue of *Gas Logic*, over which number Editor Livingstone may justly feel content, Dr. H. W. Wiley, formerly well-known as the Chief of the Bureau of Chemistry, U. S. Dept. of Agriculture, presents the appended short article that is certainly worth reading—the Doctor though, it seems to us, might have omitted the initial "If:"

If a gas stove will make cooking more attractive to the women of America, so that they will consider it not so much of a drudgery, it will be a social and economical blessing. Considering the miscellaneous character of fuel used in our stoves, I sometimes think that the unreasonable prejudice against cooking, which prevails to so large an extent among American women, may be due chiefly to trouble with the fire. If that were under complete control, as it is in the case of a gas stove, probably cooking would become more common, fashionable and of greater excellence. Waste in the kitchen, run entirely by servants, keeps many a poor man a bachelor and a corresponding number of young women "old maids." How many more happy marriages there would be if the young girl would say to her fiance, "My only dot is a gas stove, and I know how to use it!" If this were the case there would not be so many of our fine girls carried off to Europe every year. I think it would be advisable for some enterprising manufacturer to put out a line of stoves entitled, "The Matrimonial Gas Stove," and advertise it properly in the newspapers. Lately I saw a statement that a man advertised some beer in the newspapers, and got so many orders that he had to have more people attending to the correspondence than he had making the beer. Naturally I would expect a small royalty on each of the "Matrimonial Gas Stoves," the magnitude thereof working inversely to the income tax. I might be content with $1 each for the first 1,000, 75 cents for the second 1,000, 50 cents for the third 1,000 and 10 cents each for all above 100,000. This seems reasonable in view of the unmingled joy which would be universally produced. It also implies that the American girl would learn to operate the stove. A matrimonial gas stove cooking school might be established, and each graduate of this school might receive a certificate entitling her to one gas stove. Of course, this would be on condition that she did not live in Chicago, where the number of gas stoves, due to the facility of divorce, would be unduly large.

Good cooking should be looked upon as a fine art, as much so as good music, painting or fine needlework, and as a fine art of greater utility. Every American girl should learn to cook and to cook well. I do not mean by cooking well to be able to make ice cream and cake, for we could live without these dainties far more happily than with them; but I mean the ability to boil eggs, potatoes, to broil a steak, make a ragout, or that economical and nutritious and much despised dish, known as hash, without which no family can live economically and happily; or bake a loaf of bread, so that the poor husband would not be sentenced to a life of baking powder biscuits, so-called, which I think should be better known as lazy substitutes for bread.

The gas stove will do away with much of the discomfort of the kitchen, especially in the summer time, when the heat of the range begins long before the meal is prepared and lasts long after it is over.

The county clerk should refuse a license to wed to any girl who does not know how to cook, and should only grant it finally when she takes a solemn oath to practice what she knows. The compact gas stove, moreover, would occupy less space than one of the vogue hats, and is far more beautiful to look at, however homely its shape may be, and should not cost as much and would last a great deal longer. Let us hope that the modern hat will be literally and figuratively a bird of passage, while the gas stove will come to stay.

The Marinette Rate Decision.

The Wisconsin Rate Commission recently issued a mandate respecting the rates for electric lighting and changing those for electric power at Marinette, Wis., thus winding up the case of the Menominee and Marinette Light and Traction Company. This company operates the street railway, electric lighting and electric power plants in Menominee, Mich., and Marinette, Wis., and the matter before the commission was as to the rates to be charged in Marinette. The company made application for an equalization of rates and submitted a schedule which the commission refused to allow to be put in force. The city asked for a hearing on the rates, alleging that they were unjust and discriminatory and hearings were held together.

The commission finds that unjustifiably low rates have been charged in some cases to users of current for power and that the result of discrimination has been that rates too high have been charged for residence lighting, for part of the business lighting and for a part of the current for power purposes.

This case was gone into very thoroughly and carefully, as is shown by the fact that the application was made January 21, 1908, and the decision has just been rendered after months of work on the part of the engineering force, the statistical force and the members of the commission itself. At one time the commission refused to dismiss the application of the city for lower rates. It had been maintained that the company was planning to obtain current generated by water power, make various additions and put in improvements; but the commission held that because at some time in the future this was planned, was no reason why service should not be delivered at reasonable rates at the present time.

In its findings the commission declared that electricity may be considered a service rather than a commodity and this should be taken into account. It cannot be stored up ready for use, but the plant must be ready to furnish it when required. It is declared that depreciation must be prepared for by the company and that money which should properly go into the fund for this purpose should not

be paid out to stockholders. It is found that the matter of depreciation has not always been properly treated by the company.

Deterioration, rate of interest on investment and taxes and insurance, are all counted as fixed charges, and it is held that they are not affected by the output of an electric plant nor by the extent to which the plant may be used. They are held to affect one consumer just as another. But the variable expenses are a different proposition and are held to increase with the output. The fixed charges are found to be generally the greater. A flat rate is held by the commission to be objectionable. In this case a consumer for a short time is compelled to pay as much as a consumer for a long time. A straight meter rate is held to be satisfactory only where all consumers use electricity in the same way. The commission says it is not fair that a consumer who uses 10-kw. for 10 hours should pay as much as one who uses 100 kw. hours, the same amount, but uses it all in 1 hour. The latter takes too much of the capacity of the plant during 1 hour to be allowed to pay as small a rate as the former. The average cost per kw. hour grows smaller as the sales of current under the same maximum demand grows larger.

In making its investigations the commission's statistical force gathered great quantities of data, and the study was a thorough one. The apportionment of the active connected load was taken up in great detail and it was decided that probably one-third of the active connected load should be charged to the residence district, and that the business houses should be charged with about 60 per cent. The capacity expense is declared dependent upon the active load while the output expense is dependent upon the output of the current.

It seems that a rate of 4 cents per kw. hour had been made for users of more than $150 worth of power. The commission declares against this. It says that there is no justification for it for it is less than the output cost and such a rate should not be allowed.

Rates of the company have been as follows: 15 cents per kw. hour for amounts up to 20 kw. hours per month; 13½ cents for the next 40 kw. hours; 12½ cents for the next 40; 11½ cents for the next 40; 10 cents for the next 40, and 8 cents for consumption of more than 180 kw. hours per month. The commission orders a rate for incandescent lighting of 13 cents per kw. hour for the first 30 hours per month; 8 cents for the next 60 and 4.5 for each additional. It is held in fixing this rate that the active connected load or demand for residences shall be considered as 33 per cent. and for business houses of 60 per cent.

An optional rate of 16 cents per month for each 50-watt lamp demanded and 4.5 cents per kw. hour for current consumed is allowed the company. The power rate is made 50 cents per horse power per month of nominal rated capacity of the motor, and 3.5 cents per kw. hour for current consumed. This is a change from a rate of 8 cents per kw. hour for users of 100 kw. hours; 7 cents for 200 kw. hours, down to 3.25 cents for 1,000 kw. hours and over.

Much work was necessary on this case on account of the fact that the same company has practically all the gas, power, street railway and light utilities at both Marinette, Wis., and Menominee, Mich.

Special English Correspondence.

COMMUNICATED BY NORTON H. HUMPHRYS.

SALISBURY, ENGLAND, August 10th, 1909.

Official Gas Tests in London.—Locks for Slot Meters.—The Porhydrometer.—Half Year's Working of the London Gas Company.

In view of the impending alterations in the penalty clauses, in respect to the quality of the gas supplied by the Gas Light and Coke Company, which includes more than half of the total supply to the metropolis, special interest attaches to the periodical reports of the official gas examiners, and some interesting details may be gathered from those for the second quarter of the current year, as recently issued. First, as to the photometrical tests. The value of these, so far as the consumer is concerned, may be estimated from the fact that the penalty or statutory tests are taken with the argand burner, which is practically obsolete outside the testing room, and that the official examiners do not appear to be aware of the existence of the incandescent gas burner, or of the fact that it is responsible for the consumption of 80 to 90 per cent. of the total quantity of gas consumed for lighting. The relation of the official test to the consumer of gas is about as intimate as the speed of a horse to the rate of travel of an ocean greyhound. One official test may show 15-candle, and another 18, and it is not beyond the bounds of possibility that the consumer may get better value in the first case than in the second. Certainly for the same outlay, he does not get 20 per cent. more value out of the higher priced gas. As much may be said for the Parliamentary Standard. The representatives of the public have spent hundreds and thousands of the ratepayers' money in fighting for another candle, or perhaps two. But the official tests reveal the fact that the Gas Light and Coke Company, with a standard of 16, supply gas averaging 16.75 candles, while the South Metropolitan, with a standard of 14, supply 16.64-candle, or practically the same quality. It would be absurd to suggest that the engineers of the South Metropolitan, who are always recognized as being in the very front rank of makers of cheap gas, do not know how to make 14½-candle gas at a cheaper rate than 16½, and equally ridiculous to suppose that, for sentimental reasons, they do not care to send out a lower quality gas than their large neighbor. Mere sentiment is not to be looked for in the ranks of the robust exponents of copartnership. The more probable supposition is that they do not find that the lower quality gas suits their consumers, and it emphasizes a point I have raised on previous occasions—that the official test is of no value to the consumers and that they would be just as well off without it. In its absence the gas company—I say *company* emphatically, because the question does not come to the front when the gas undertaking is the property of the municipal authorities—who at present pay for a slight defection below the standard by a 40s. fine handed over to a magistrate's clerk, would suffer for any substantial shortage in respect to quality by the more indirect but not tangible loss of business and prestige.

Tests are also made with a flat flame burner of the batswing type, and it is remarkable that in all cases the results are only about two-thirds of the value recorded by the official test. If a standard batswing burner, properly adjusted in the matter of pressure, and protected from draught, only yields a duty of 2.2 candles per cubic foot, what value may the average consumer be expected to get from it under the rough and ready conditions of everyday life? Why any consumer should prefer to retain a form of burner, which is proved to give a maximum duty of 2.2 candles, when 20 to 25 candles is readily obtainable, is not easy to answer. And a person so blind to his own interests is scarcely a deserving object for official protection. In the entire absence of such the consumer might appreciate the fact that the remedy for bad gas is in his own hands.

The chief point, however, is the calorific tests. These are remarkably regular, the fluctuations between maximum, minimum aud average being less, as expressed in percentages, than those recorded by the photometer. The case of the Commercial Gas Company is noticeable. Within the last 3 years they have reduced the quality of their gas, according to the statutory test, by .8 candle, or more than 5 per cent. The reduction as shown by the flat flame is in the same porportion. But the reduction in calorific value is less than 2 per cent., viz., from 128.5 to 126. So far as 90 per cent. of the consumption is concerned, taking the gas at 2s. 6d. per 1,000 cubic feet, the reduced value would be represented by one halfpenny, although the official test would show it to be nearly 2d. I have remarked that gas engineers do not know much about regulating the calorific value of their product, but the London official reports go to show that in practice it can be maintained within a variation of 10 per cent. either way, which is more than can be said for photometrical value. It does not appear to be subject to uncontrollable and unaccountable fluctuations, as was so frequently found to be the case with the sulphur compounds. Further experience shows that the gas engineer need not regard the calorimeter with the same abhorence as he very naturally extended to the Referees' sulphur apparatus, which was the cause, not only of continual anxiety, but also of much undeserved obloquy.

A great deal of ingenuity has been expended on the locks or fastenings for the cash box of slot meters, and there is much difference of opinion amongst gas engineers as to how far protection should be carried. A successful burglary is attended not only with the loss of the current coin contained in the receptacle, but with injury to the meter itself. While some believe in a cash box fashioned after the lines of a burglar-proof safe, others argue that such precautions defeat themselves by reason of the extra damage done to the meter. A thief may wrench a padlock off with a pocket knife, pocket perhaps 5s., and do damage to the extent of 2s. 6d. to the meter. But when he finds a burglar-proof contrivance, he gets a sledgehammer and crowbar, or perhaps takes away the meter bodily, and so does damage very considerably exceeding the value of the money stolen. Burglaries can be kept down to a trifling percentage, but a burglar-proof cash box represents a substantial increase in the cost and in the weight of every meter sent out. The question must be decided by the business qualities, the amount of determination and perseverance and

the character of the burglars in each district. A youth of dishonest tendencies, who looks at the slot meter as a means of providing the funds for betting or for a night out, would probably be deterred by a strongly constructed till. The professional burglar may, on the other hand, accept it as a challenge, and he has very long odds in his favor. It is said that an Irishman at the fair, if he sees the shape of a man's head showing on the outside of a tent, cannot help hitting it. No doubt, a loosely attached hasp or hank that offers an easy grip for the chisel or file presents similar attractions to the dishonorable mind. And all will agree on the advisability of making the padlock as solid, compact and unobtrusive as possible. This condition is admirably met in the Reeves padlock, which sits closely to the door and contains the hasp inside it. With a little modification it could be made without any projecting part whatever, so as to resemble in shape a small matchbox. It is self-locking, so that the fitter who takes the meter out need not carry a key, nor is it necessary to see that it is locked before leaving the company's premises. It is simply put together, and when this is done it cannot be opened without the proper key.

The Porhydrometer is, notwithstanding its ugly name, a remarkably ingenious idea and capable of important application. It is a device for indicating the amount of displacement caused by loading a cargo into a freely floating vessel. The weight represented by such displacement admits of accurate calculation, and, therefore, it is easy to construct a scale for any lighter or cargo vessel. Take a ship load of coal for example. Those accustomed to have their supplies of coal brought by water know that the weighing represents a large expense and that it is difficult to locate errors or discrepancies. But the Porhydrometer gives the reading in one total, and both loading and discharging are greatly expedited. The system is in effect based on the well known principle said to have been discovered by an ancient philosopher while taking his bath, and who is stated to have been so overjoyed by his discovery that he immediately left for home in an undignified and hurried manner not becoming to a philosopher. Let us hope that the inventor of the Porhydrometer, whose name, by-the-way, is Signor de Lorenzi, did not incur the risk of being summoned for indecent bathing at the time that he made his discovery. A vertical tube is fixed in the center of the vessel, of sufficient length to include the empty displacement and the fullest practicable load. A branch extends from it to the outside of the vessel and must be situated at the lowest part of the tube, or at any rate well below the highest or empty displacement. This branch is closed by a valve when the apparatus is not in use, and it will be readily understood that when the valve is opened the water rises in the tube to the same level as that outside. There is a suitably designed float and a system of levers for indicating the movements of the float on a graduated scale. Or the float may be fixed and the variations in weight caused by the different levels to which it is immersed can be registered by means of a steel yard and balance weights. The idea appears to be capable of wide application both on a large and on a small scale.

The reports of the London Gas Companies for the 6 months ended 30th June, 1909, have been issued and they indicate a satisfactory state of affairs. The result of the half year's working is sufficient profit to pay statutory dividends and to leave a respectable surplus to carry forward. The Gas Light and Coke Company are able to record an increase in consumption of gas, notwithstanding the mild, light, weather in the early part of the year. The report also mentions that co-partnership has now been established amongst the employees and that over 8,000 officials and workmen have accepted it. This is a most important acquisition to the cause of co-partnership, and the results will be watched with great interest. The fact that the whole London supply and also several of the suburbs have adopted the scheme that was inaugurated and originated by the late Sir Geo. T. Livesey, cannot fail to attract public attention. The report of the South Metropolitan Gas Company is signed by the new Chairman, Mr. Charles Carpenter. Sales of gas have been stationary, but it is hoped that the reduction of 1 penny per 1,000 cubic feet to be made as from Michaelmas last will encourage consumption. Improved carbonizing methods have brought about a saving of 30,000 tons of coal during the half-year, and enabled the Company to obtain a record sale of gas per ton of coal carbonized—over 11,000 cubic feet. The Company are discouraging the use of the water slide gaselier, and allow them if requested, at their own cost, and more than 20,000 of these unsafe appliances have as a result disappeared during the half-year. Mr. W. Doig Gibb, Engineer of the Newcastle and Gateshead Gas Company, has been appointed Chief Engineer to the Company, and it is needless to add that this selection meets with unqualified approval in the profession.

Items of Interest
FROM VARIOUS LOCALITIES.

Mr. Wm. Hulswitt, at present General Manager of the Stoughton (Wis.) Light and Fuel Company, has accepted the position of Manager to the Ironwood (Mich.) Gas Company. Mr. Hulswitt will continue in general charge of the Stoughton plant, Mr. Julius H. Dawes acting as local Manager.

A correspondent in St. Louis, Mo., writing under date of the 20th inst., says: "Mr. R. J. Marks, of Norfolk, Va., is refilling 2 benches of 6's, rear clinkering, with Star retorts and settings, complete, with furnace."

"F. L. S., writing from Philadelphia under date of the 20th inst., incloses the following: "The Suburban Gas Company, which is gradually extending its service to all points in Delaware county, started this week to put down new mains through Essington and contiguous territory; also, through Secane and the section contiguous thereto. In speaking of the Company's work, Manager John D. Shattuck said that since last April the corporation had laid more mains in the county than during the whole of any two years preceding since the Suburban Gas Company has had control of the situation. The business is increasing according to the demands of the people, which demand is certainly taking on an imposing trend. This week, too, a picture of the Company's 'rolling stock' in various sections in the county, was taken, the drivers having received orders to rendezvous at Folsom, a point easy of access and assembling for the wagons at Chester, Derby and other points. There were 24 wagons, 4 automobiles and 4 motor cycles, which make up an imposing array. Improvements to the coke ovens at the foot of Highland avenue are about completed and, though he has been pretty well kept to the grindstone, he will have soon the benefit of easier working that is sure to come through the changes. You'll likely have him over in New York next October, especially if 'Billy' Sullivan, of Flushing Borough, does not go to Europe."

The annual summer festival of the Mutual Aid Association, composed of the employees of the New York and Richmond Gas Company, of Staten Island, N. Y., was successfully brought off the afternoon and evening of the 19th inst., the trysting place being Happyland, South Beach. It was the eighth renewal of the affair, and, as one who shared in its pleasures, said: "There never was a moment when the affair was not enjoyable." It is a certainty that the Association becomes, with the going on of time, stronger, better, more praiseworthy. The President of the Association is Mr. William J. Welsh, the Company's clever Superintendent of Works.

In the revised rolls of the Tax Commission of New York, setting taxable values for the next levy, the assessment of the properties of the Consolidated Gas Company is lessened in the sum of $19,424,000, as compared with the figures for 1908.

"A. S. B.," writing from St. Louis, Mo., under date of the 20th August, says: "It is interesting to note how the gas engineer and his work are taken advantage of in other trades. I have word that a special arch and bench of 4's have been designed for a chemical plant in Chicago, which is the first bench of its kind ever put into use having through retorts, 12 feet in length. They are charged from one end by mechanical means and are drawn by a rake. An elaborate system of drying flues has been attached, whereby the waste gases, after being used in the ordinary way by heating the secondary air, are taken through the flues for drying the material which is to be charged to the retorts. It would appear from this that readers of 'Little Hints' are taking a hint and trying out the new Star benches."

Messrs. Deily & Fowler, of Philadelphia, are under contract to construct for the Capital City Gas Company, of Des Moines, Ia., a storage holder up to retaining 100,000 cubic feet. The agreement calls for the finishing of the vessel on or before January 1st, 1910.

The main to connect Southington, Conn., with the works of the Meriden Gas Light Company, is virtually finished, and there is little doubt that gas will be sent through it Wednesday next.

A correspondent in Salt Lake City, Utah, writing under date of the 20th inst., says: "After months of keeping at it, Messrs. Short, Elliott and Martin, of the Gold Springs Mining and Power Company,

contracts have been awarded for the building at Modena, Utah, of a very complete gas producer electric plant. The contracts were made directly with the Westinghouse Machine Company, and the task of installation is in the care of the Richmond Machinery Company, of Salt Lake City. Construction work is to be started at once, and it is specified that the plant shall be in running order, under penalty of prescribed forfeitures, by December 8th. The plant, the appropriation cost of which is $50,000, is to include two 190-horse power, Westinghouse, bituminous gas producer engines; two 16 by 18 three-cylinder gas engines of 162-horse power at an altitude of 5,500 feet, and two 110-kilowatt generators with complete electrical equipment. Construction is to be upon the 2-unit plan throughout, both as a matter of economy in operation and to provide against possible close downs when any portion of the machinery gets out of order."

JUDGE MUNDEN, in the Superior Court of Oklahoma, has decided that the franchise recently voted by the officials of Oklahoma City to the projectors of the Oklahoma Gas and Electric Company is in all respects valid. The case was brought originally by the City Attorney (Mr. Twyford) to test the validity of the franchise, to secure an expression from the court so that the Company could market its bonds, the sale of which means a transaction involving at the lowest estimate, $500,000."

MR. WILLIAM H. LEONARD, formerly inspector for the Milford (Mass.) Gas Company, and virtually assistant to Superintendent E. J. Nutter, of that Company, has been appointed Third Member of the Board of Fire Engineers, of Milford. He succeeds Mr. Thomas F. Maher, formerly Chief of the Board.

THE Denver (Col.) Gas and Electric Company has notified the holders of its $250,000, 3-year, 7 per cent. collateral trust notes, issued September 1, 1907, that, in accordance with provisions contained in the notes, it will exercise the option of retiring them the 1st prox., at par and a premium of 1 per cent., plus accrued interest. The Company seems to be doing a tremendous business in the fuel gas line, since its returns on account of gas ranges sold show that, up to the 1st inst., more ranges had been placed than during the entire twelvemonth of 1908. They give canvassers some sort of inducement to work out in Denver—in fact, that is so wherever Mr. Doherty has much to say in the management.

CONTRACTORS might keep an eye on Wilmington, Del., for we understand that about the first large contract on betterment account that will be let will have to do with the construction of an additional storage holder.

MANY of the old-timers will learn with regret of the death of Colonel Wm. B. Sellers, who for many years was the capable Secretary of the Covington (Ky.) Gas Light Company. He was in his 74th year, having been born in Lebanon, O., November 11th, 1835. He is survived by his widow, a daughter and 2 sons. He was one of the best accountants in the West, and was a man of a singularly even-dispositioned character.

MR. NICHOLAS WAY, Superintendent of the Lisbon (O.) Gas and Electric Company, died at his home in Lisbon the evening of the 16th inst. He was in his 65th year, having been born in Cincinnati in 1844. He is survived by three daughters and three sisters.

THE Bristol (Tenn.) Gas and Electric Company has determined to double its generating capacity, and with that end in view will install an additional turbine engine. It has also been agreed on to construct an additional storage holder on the gas division of the property.

THE Board of Trade of Center Moriches, Long Island, N. Y., is circulating a paper amongst the residents, with the request that those receiving it return the same forthwith, signed either for or against the construction and operation of a gas works on that stretch of shore of the Great South Bay.

THE Wormleysburg (Pa.) Common Council has granted a franchise for the operation there of a gas works, to the projectors of the Wormleysburg Gas Company.

THE Evansville-Peoria-Rockford-Springfield syndicate, which controls the gas, electric lighting and street railway properties of the named Illinois and Indiana business centers, is beginning to show the "big stick" method of "cutting down operating expenses." One of those so "marked" is Mr. George R. McDonald, General Manager of the Evansville (Ind.) Gas and Electric Light Company, who has been told that January 1st his position will be abolished; and another division superintendent (Mr. O. P. Tills), who has had charge of the "extension department" in the instance of gas distribution, will have to find a new post of duty "on and after October 1st."

EDITOR HORACE BEESON, of our contemporary "Gas-ps," which monthly publication is issued at the instance of the Suburban Gas Company, of Philadelphia, is out with the September number. As usual, there is much in it that is "all to the fruit." The successful prize contestants in the recent "Jingle Contests" are named in it, so are the names of the prize winners. The first prize went to the writer of the following jingle—the singnature given was the unobtrusive one of "Swarthmore:"

> "No effort, no dirt, no servant, no 'sass,'
> For all the year round I cook with gas."

THE new gas works at Weathersford, Tex., was successfully put into commission about a fortnight ago.

HEREAFTER no public lighting contracts in Minneapolis, Minn., will be based on the phases of the moon. All night and every night service is to rule hereafter. It surely does seem that this determination was reached at a time and day (or night) rather late. However, better now than never.

MR. W. LEE COSGROVE, who will be well remembered by the old guard as the capable President of the Atlanta (Ga.) Gas Light Company, is back again in his own country after an absence of 10 months, which time was taken up in a trip that practically circled the world.

Coke Production, 1908.

According to the advance sheets of the Government report respecting the coke production of the country for the year ended June 30th last, as computed by Commissioner Parker, the quantity of coke produced in Pennsylvania in 1908 was 15,511,634 net tons, out of a total for the United States of 26,033,518 net tons. In 1907 Pennsylvania produced 26,513,214 tons out of a total of 40,779,564 tons. The production in 1908 showed a decrease of 11,001,580 tons, or 41.5 per cent. from that of 1907, or of 7,548,877 tons, or 32.7 per cent. from that of 1906. The years 1906 and 1907, however, were years of plenty in the coal mining and coke producing industries, and can hardly be considered representative of the normal production. If, however, the production of Pennsylvania in 1908 is compared with the average of the 8 preceding years, it is noted that the production still shows a decrease of 2,597,188 tons, or 14.3 per cent. The production in 1908 was the smallest since 1904.

The conditions in 1908 were almost a direct contrast to those which prevailed during the preceding year. During 1907 until the effects of the financial troubles began to be felt there was scarcely a time that the production was in excess of the demand, whereas in 1908 the occasions were just as scarce when the supply was not in excess of the market requirements. The result of these conditions is exhibited in the proportionately larger decrease in the value of the coke as compared with the decrease in product. The total value of the coke produced in Pennsylvania in 1908 was $32,569,621, against $67,638,024 in 1907, showing a decrease of 51.8 per cent. The decrease in tonnage was 41.5 per cent. The decrease in the value of the production in 1908 was greater than the value of the entire coke output of Pennsylvania in 1904.

The average price per ton obtained for coke in Pennsylvania in 1908 was $2.10 at oven, as compared with $2.55 in 1907, $2.35 in 1906, and $2.05 in 1905. The only reason to be assigned for the excess in the 1908 price over that of 1905 is the fact that operators were able through contracts to maintain prices and thus prevent entire demoralization, and also the fact that a large proportion of the coke produced in Pennsylvania is not placed on the market but is used by the producers themselves or by allied interests, and the value placed upon it is purely arbitrary.

The quantity of coal consumed in the manufacture of coke in Pennsylvania in 1908 was 23,215,964 net tons, valued at $23,250,885. This represents 19.81 per cent. of the total production of bituminous coal in Pennsylvania during the year. In 1907 the consumption of coal in the manufacture of coke was 39,733,177 net tons, valued at $42,732,546, representing 26.4 per cent. of the State's total bituminous coal production. The much smaller percentage in the quantity of coal used for coke making in 1908 as compared with the preceding year indicates that the decrease in the demand for coke by the iron furnaces was in greater proportion than that in the demand for coal from other consumers of fuel. The difference between the value of the coke and the value of the coal from which it was made in 1908 was $9,318,736, or 40.1 per cent.; in 1907 the difference was $24,905,478, or 58.3 per cent.

The number of coke making establishments in 1908 was 252, one less than in 1907, though the total number of ovens in the State increased from 51,364 to 52,606. Of these establishments 44 were idle, and of the 52,606 ovens, 3,616 were out of blast throughout the year.

THE AMERICAN GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
PROPRIETORS.

THOS. J. CUNNINGHAM,
ELBERT P. CALLENDER,
EDITORS.

CHARLES H. WADELTON,
MANAGER.

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The Market for Gas Securities.

Consolidated showed a strong tendency in the week to go nearer to its own. It touched 148 for a brief spell, but Mr. Harriman's home-coming in a physical condition not altogether reassuring, was sufficient to break the general market in a degree approaching the violent. This thing shows in itself how disconnected the speculative market is as a whole. If Mr. Harriman were to die to-day (and we hope that day is very far distant, since he is a living monument to the greatness of America's strongest aids to our development the railroads), his death should not in any practical sense affect gas shares, particularly Consolidated. However, that went down with the rest. There is good reason for an increase in its value; there is none whatever for a decline in it.

As a rule gas securities (particularly bond issue) are strong. Bay State is again somewhat in evidence, at 1¼ to 1½.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

16 WALL STREET, NEW YORK CITY.

AUGUST 30.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share:

N. Y. City Companies.	*Capitol.*	*Par.*	*Bid.*	*Asked.*
Consolidated Gas Co.	$78,177,000	100	145	145¼
Central Union Gas Co.—				
1st 5's, due 1972, J. & J.	8,000,000	1,000	98	101
Equitable Gas Light Co.—				
Con. 5's, due 1932, M. & S.	1,000,000	1,000	—	105
Mutual Gas Co.	3,800,000	100	155	165
New Amsterdam Gas Co.—				
1st Con. 5's, due 1948, J. & J.	11,000,000	1,000	100	101½
New York & Richmond Gas Co. (Staten Island)	1,500,000	100	37	43
1st Mtg. Gold Bds. 5 p. ct.	1,000,000	—	100	101
New York and East River—				
1st 5's, due 1944, J. & J.	3,500,000	1,000	104	107
Con. 5's, due 1945, J. & J.	1,500,000	—	97	101
Northern Union—				
1st 5's, due 1927, J. & J.	1,250,000	1,000	94	100
Standard	5,000,000	100	—	75
Preferred	5,000,000	100	70	100
1st Mtg. 5's, due 1930, M. & N.	1,500,000	1,000	100	105
The Brooklyn Union	15,000,000	1,000	145	150
1st Con. 5's, due 1948, M. & N.	15,000,000	—	91½	92
Yonkers	299,650	500	180	—
Out-of Town Companies.				
Bay State	50,000,000	50	1⅛	1¼
" Income Bonds	2,000,000	1,000	—	75
Binghampton Gas Works	450,000	100	—	65
" 1st Mtg. 5's	509,000	1,000	90	96
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	5	8
Bonds, 5's	5,250,000	1,000	73	73½
Capital, Sacramento	500,000	50	—	35
Bonds (6's)	150,000	1,000	—	—
Chicago Gas Co. Guaranteed Gold Bonds	7,660,000	1,000	104	105½
Cincinnati Gas and Electric Co.	22,500,000	100	92	93
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,500,000	1,000	96	98
Columbus (O.) Gas Lt. & Heating Co.	1,682,750	100	90½	91
Preferred	3,036,500	100	75½	80
Consumers, Toronto	2,000,000	50	200	204
Consolidated, Baltimore	11,000,000	100	—	105
Mortgages, 6's	3,600,000	—	—	118
Chesapeake, 1st 6's	1,000,000	—	—	—
Equitable, 1st 6's	910,000	—	—	—
Consolidated, 1st 5's	1,490,000	—	—	112
Consolidated Gas Co. of N. J.	1,000,000	100	15	17
Con. Mtg. 5's	880,000	1,000	92	95
Bonds	75,000	—	—	100
Denver Gas and Electric	458,000	—	102	105
Detroit City Gas Co	5,000,000	50	—	50
" Prior Lien 5's	4,619,000	1,000	97	100½
Detroit Gas Co., 5's	881,000	1,000	75	80
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	—	102
Essex and Hudson Gas Co.	6,500,000	—	39	40
Fort Wayne	2,000,000	—	—	—
" Bonds	2,000,000	—	55	—
Grand Rapids Gas Light Co., 1st Mtg. 5's	1,225,000	1,000	104½	105
Hartford	750,000	25	190	200
Hudson County Gas Co., of New Jersey	10,500,000	—	112	113½
" Bonds, 5's	10,500,000	—	103	103½
Indianapolis	2,000,000	—	60	70
" Bonds, 5's	2,650,000	—	104½	105
Jackson Gas Co.	250,000	50	82	—
" 1st Mtg. 5's	290,000	1,000	97	100
Kansas City Gas Light Co., of Missouri	5,000,000	100	—	36
Bonds, 1st 5's	3,822,000	1,000	102	104
Laclede Gas Co., St. Louis	10,000,000	100	104	105
Preferred	2,500,000	100	—	98
Bonds	10,000,000	1,000	104	—
Lafayette Gas Co., Ind.	1,000,000	100	—	60
Bonds	1,000,000	1,000	60	65
Louisville	2,570,000	50	143	145
Madison Gas and Electric Co.				
" 1st Mtg. 6's	350,000	1,000	106	108¾
" 6 per cent. scrip, due 1910	100,000	25	60	60½
Massachusetts Gas Companies, of Boston	25,000,000	100	65	65¼
Preferred	25,000,000	100	90¾	—
Montreal Gas Co., Canada	2,000,000	100	218	218¾
Nashville Gas Light Co.	1,000,000	100	110	—
Newark, N. J., Con. Gas Co.	6,000,000	—	56	58
Bonds, 6's	6,000,000	—	127	128
New Haven Gas Co.	2,000,000	25	200	—
Peoples Gas Lt. & Coke Co., Chicago	25,000,000	100	115	115¼
1st Mortgage	20,100,000	1,000	—	—
2d "	2,500,000	1,000	104	—
Rochester Gas & Electric Co.	2,150,000	50	88	—
Preferred	2,150,000	50	118	—
Consolidated 5's	2,000,000	—	104⅜	105⅛
San Francisco Gas Co., Cal.	15,500,000	—	—	—
St. Joseph Gas Co.—				
1st Mtg. 5's	751,000	1,000	100	102
St. Paul Gas Light Co.	1,500,000	100	45	47
1st Mortgages, 6's	650,000	1,000	113	116
Extension, 6's	600,000	1,000	112¾	115
General Mortgage, 5's	2,465,000	1,000	90	95
Syracuse Gas Co., N. Y.	1,975,000	100	50	55
Bonds	2,047,000	1,000	100	104
Washington (D. C.) Gas Co.	600,000	20	363⅛	367½
1st Mortgage, 6's	600,000	—	—	—
Western Gas Co., Milwaukee	4,000,000	—	—	—
Wilmington (Del.) Gas Co.	600,000	50	230	—

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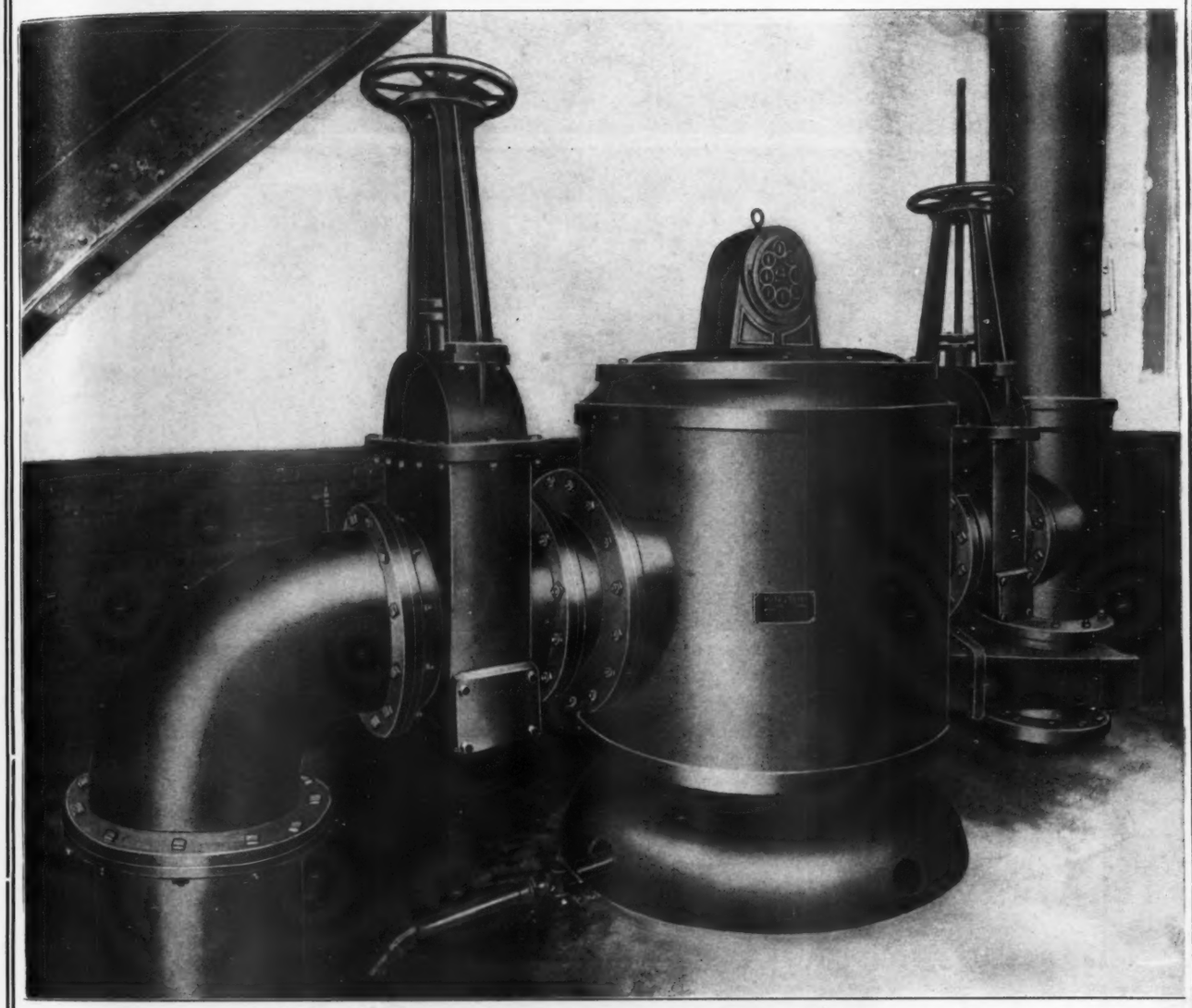

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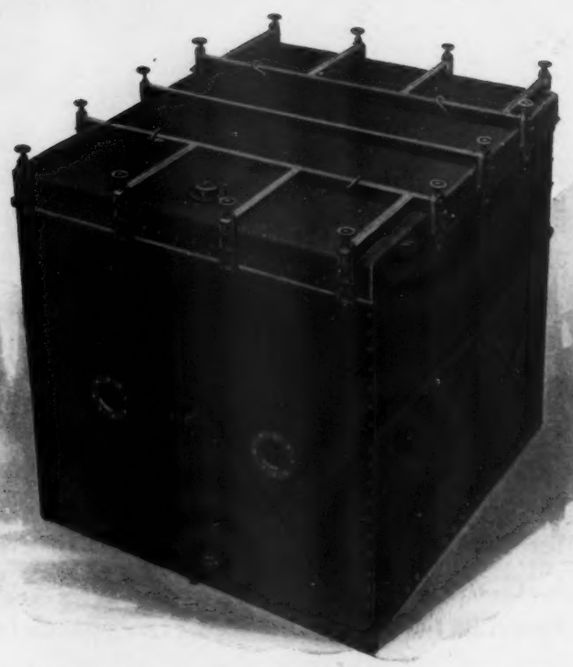

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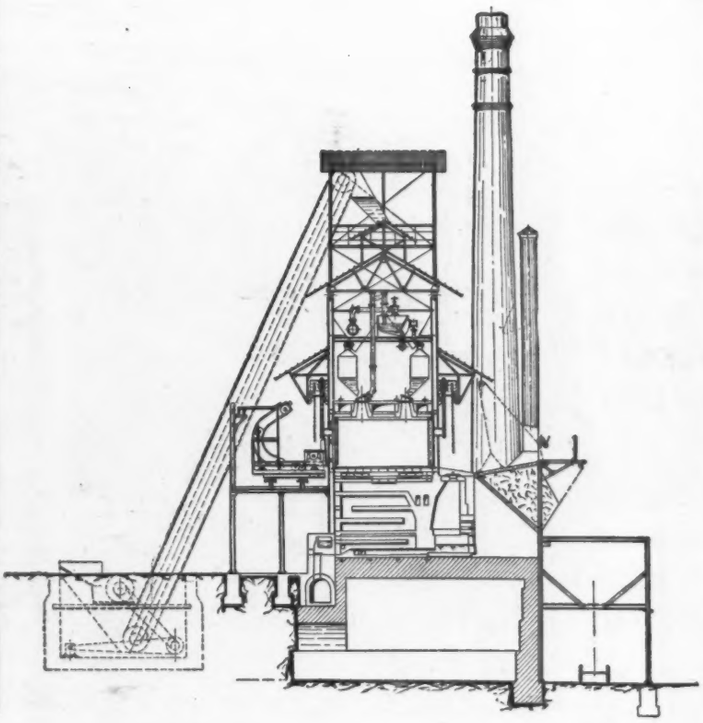

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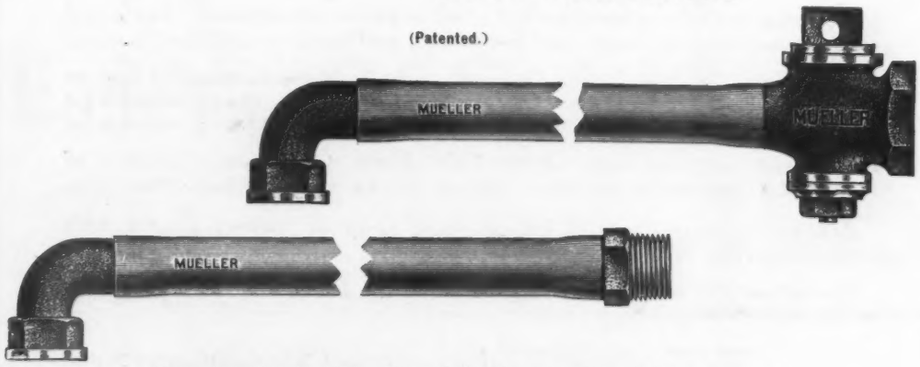

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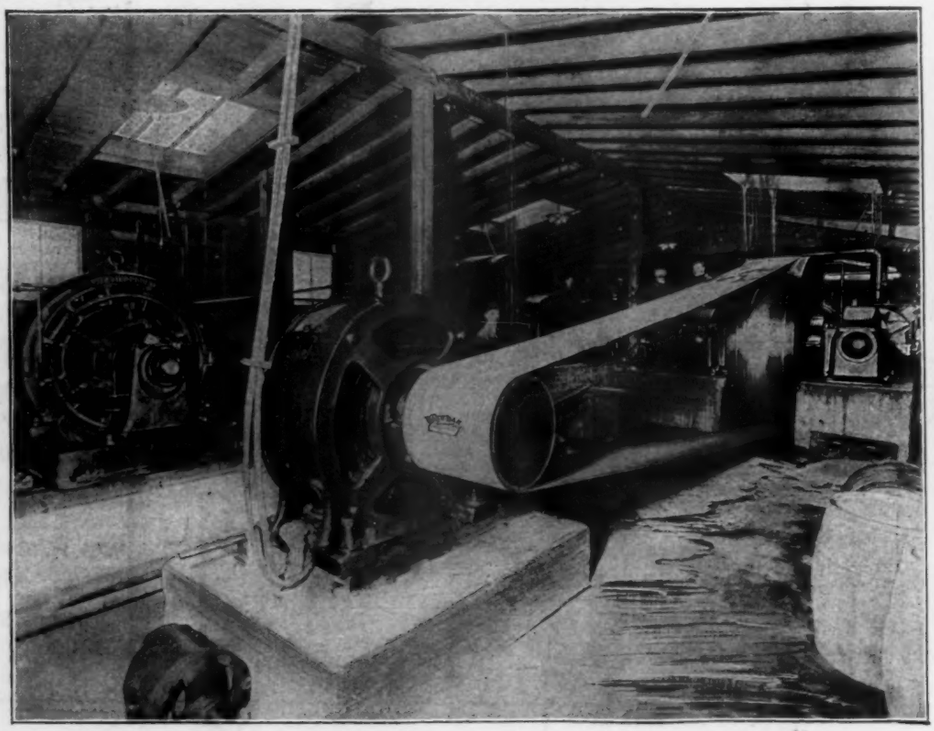

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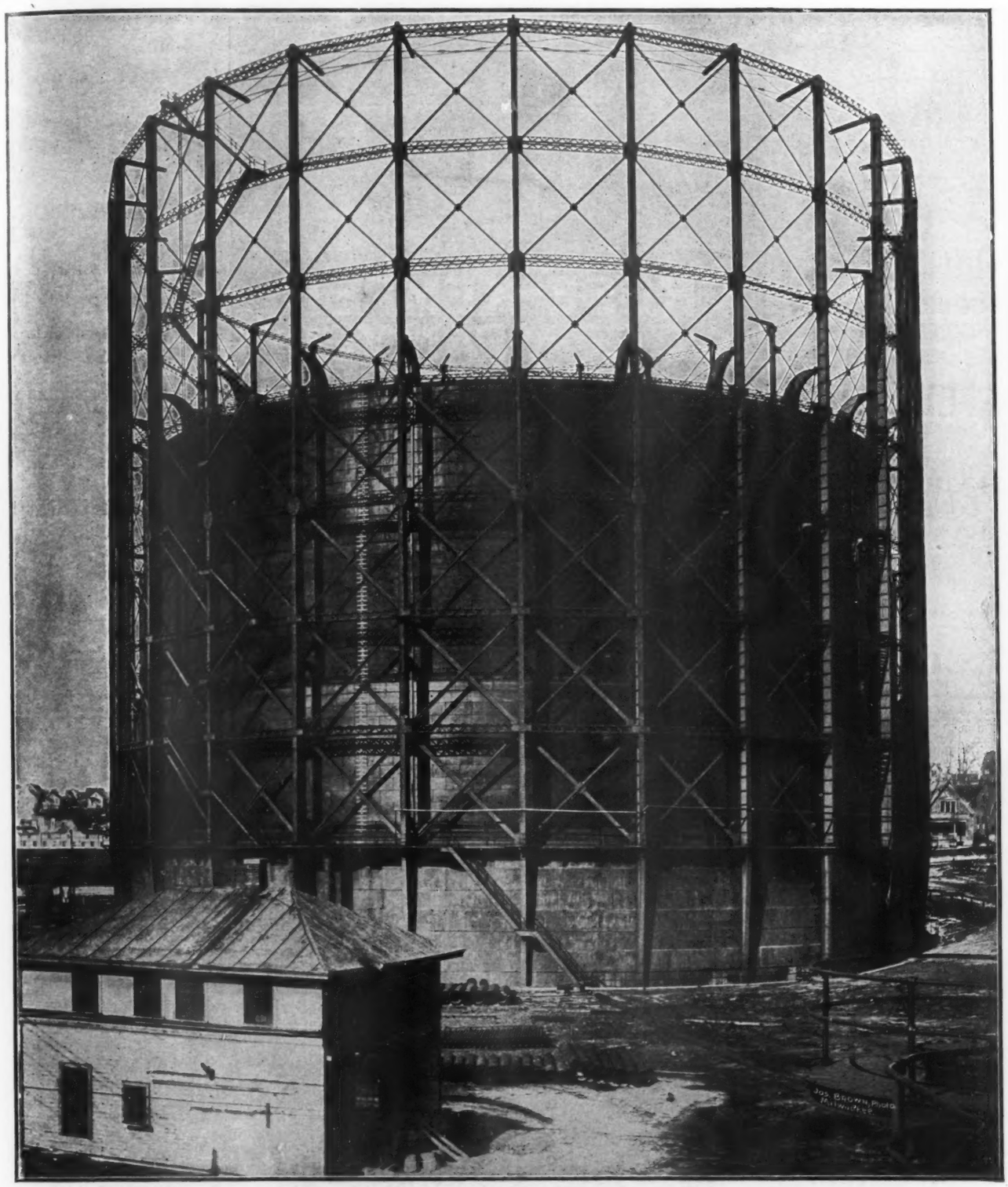

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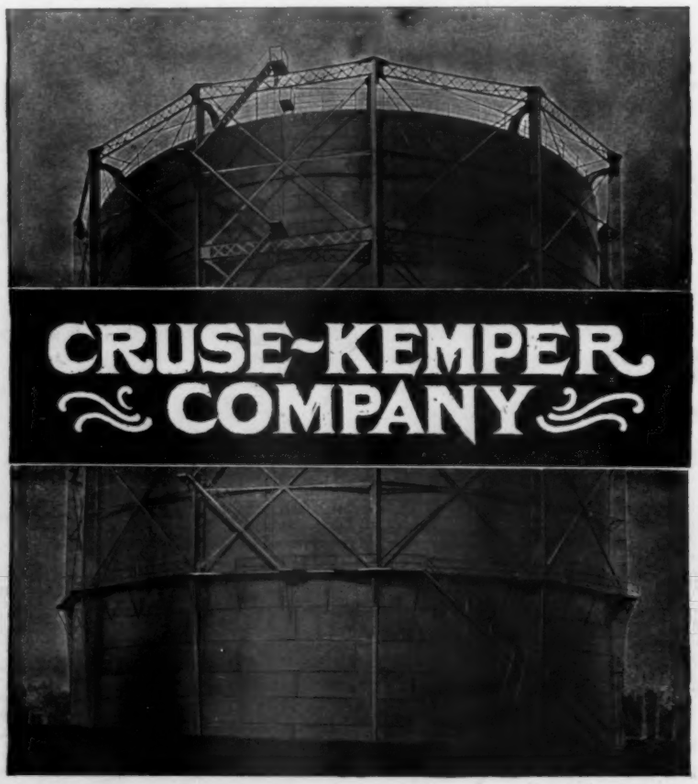

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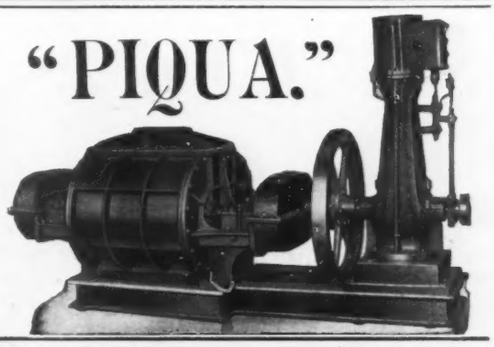

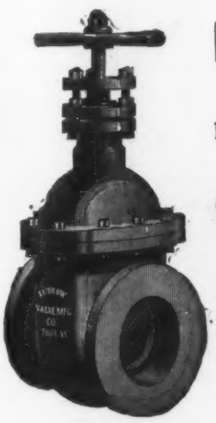

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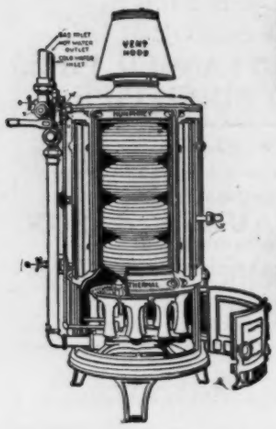

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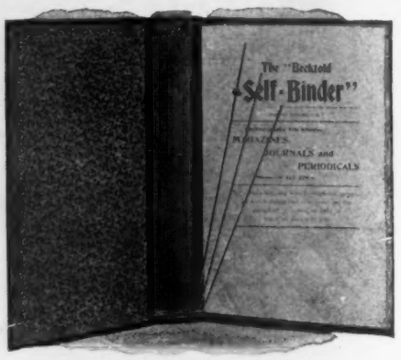

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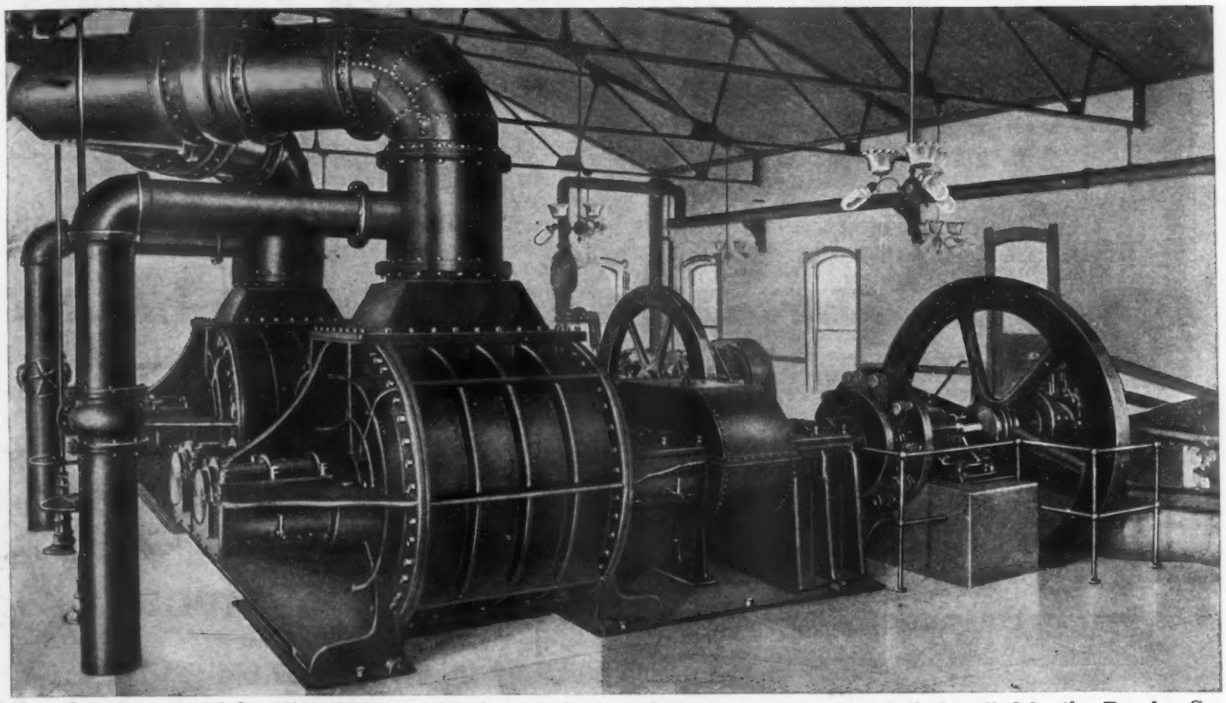

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Photometrical and Experimental Apparatus.

PUBLIC LIGHTING TABLE.

SEPTEMBER, 1909.

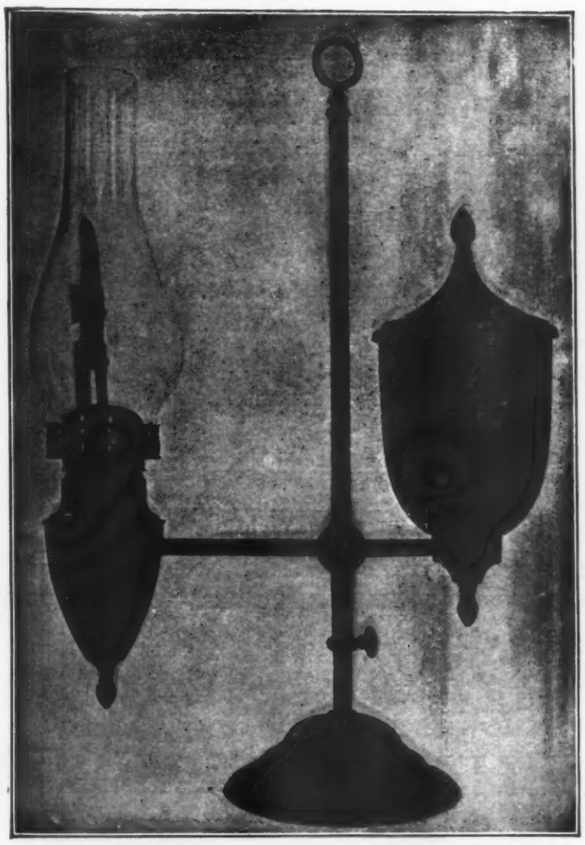
Table No. 1.
FOLLOWING THE MOON.

Day of Week.	Date.	Light.	Extinguish.
Wed.	1	7.00PM	8.50PM
Thu.	2	7.00	9.20
Fri.	3	7.00	9.50
Sat.	4	7.00	10.20
Sun.	5	6.50	11.00
Mon.	6	6.50LQ	11.40
Tue.	7	6.50	12.30AM
Wed.	8	6.50	1.20
Thu.	9	6.50	2.20
Fri.	10	6.50	3.20
Sat.	11	6.50	4.40
Sun.	12	6.40	4.40
Mon.	13	6.40	4.40
Tue.	14	6.40NM	4.40
Wed.	15	6.40	4.40
Thu.	16	6.40	4.40
Fri.	17	6.40	4.40
Sat.	18	6.40	4.40
Sun.	19	7.40	4.50
Mon.	20	8.10	4.50
Tue.	21	8.50	4.50
Wed.	22	9.40FQ	4.50
Thu.	23	10.30	4.50
Fri.	24	11.40	4.50
Sat.	25	12.50AM	4.50
Sun.	26	2.10	4.50
Mon.	27	3.20	4.50
Tue.	28	No L.	No L.
Wed.	29	No L.FM	No L.
Thu.	30	No L.	No L.

TOTAL HOURS DURING 1909.

By Table No. 1.

	Hrs.Min.
January	212.20
February	183.40
March	173.00
April	151.10
May	144.10
June	138.50
July	145.40
August	160.30
September	180.00
October	201.00
November	216.30
December	233.40
Total, yr.	2140.30



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10-Candle Power.

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This lamp is a perfect substitute for the 10-candle Pentane Lamp hitherto used, and has the following advantages:

1st. It uses Standard Kerosene Oil (Pratt's Astral Oil or equivalent).

2d. It is remarkably steady. Will burn 24 hours continuously with less than 2 per cent. variation.

3d. It is much less dangerous than Pentane, which is a kind of gasolene.

4th. It is not easily affected by air currents in the photometer room.

5th. Since the lamp may burn continuously, the candle power of gas may be taken at any moment, if necessary. This insures steady illuminating power without waste of carburetting material.

6th. The first cost of the lamp brings it within the reach of even small gas works.

7th. Costs much less to maintain than a Pentane lamp or sperm candles doing the same service.

8th. Is not affected by the weather.

PUBLIC LIGHTING TABLE.

SEPTEMBER, 1909.

Table No. 2.
NEW YORK CITY.
All Night Lighting.

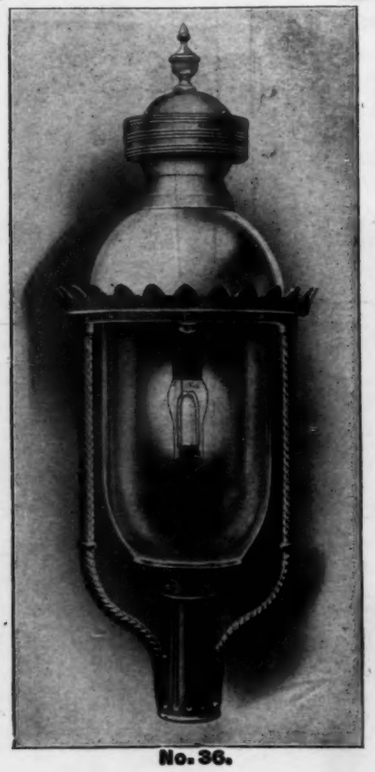
Day of Week.	Date.	Complete Lighting in One Hour (From Time Given P. M.)	Complete Extinguishing in 50 Minutes (From Time Given A. M.)
Wed.	1	6.27	3.57
Thu.	2	6.27	3.57
Fri.	3	6.17	4.07
Sat.	4	6.17	4.07
Sun.	5	6.17	4.07
Mon.	6	6.17	4.07
Tue.	7	6.12	4.07
Wed.	8	6.12	4.07
Thu.	9	6.12	4.07
Fri.	10	6.02	4.17
Sat.	11	6.02	4.17
Sun.	12	6.02	4.17
Mon.	13	6.02	4.17
Tue.	14	6.02	4.17
Wed.	15	6.02	4.17
Thu.	16	6.02	4.17
Fri.	17	5.52	4.27
Sat.	18	5.52	4.27
Sun.	19	5.52	4.27
Mon.	20	5.52	4.27
Tue.	21	5.47	4.27
Wed.	22	5.47	4.27
Thu.	23	5.47	4.27
Fri.	24	5.37	4.37
Sat.	25	5.37	4.37
Sun.	26	5.37	4.37
Mon.	27	5.37	4.37
Tue.	28	5.32	4.37
Wed.	29	5.32	4.37
Thu.	30	5.32	4.37

TOTAL HOURS DURING 1909.

	Hrs.Min.
January	428.30
February	358.15
March	353.10
April	298.10
May	263.20
June	234.45
July	248.30
August	278.00
September	311.25
October	370.05
November	397.40
December	438.35
	3980.25
Deduct on account of 50 min. extinguishing time	30.25
Total, yr.	3950.00

NEW YORK, 318 West 42d Street.
BOSTON, 820 Beacon Building.
PHILADELPHIA, Bread and Arch Streets.
ST. LOUIS, 712 Roe Building.
CHICAGO, 218 La Salle Street.
SAN FRANCISCO, 512 Oak Street.

WELSBACH STREET LIGHTING COMPANY



No. 36.

....OF AMERICA....

Controls and Operates the **Welsbach System of Street Lighting,**

Which includes its specially DESIGNED and PATENTED BURNER for PARK LIGHTING exclusively.

Uniformly SUCCESSFUL in 150 Cities and Towns.

By means of the Welsbach System of street lighting the superiority of GAS over electricity for street lighting has been fully demonstrated.

POINTS OF MERIT:

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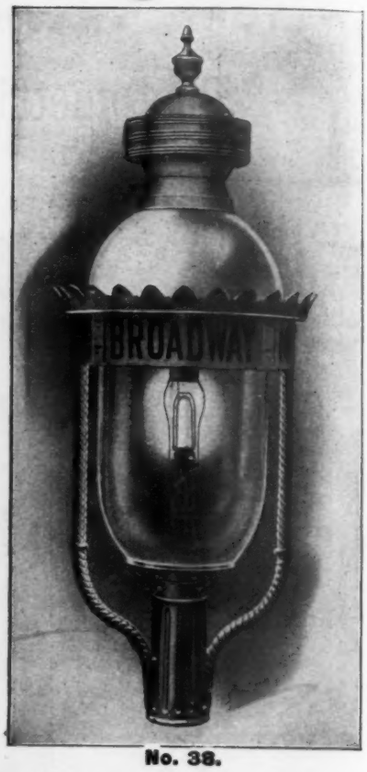
IT LIGHTS THE STREET.

Where there are no gas mains we can furnish an equally good light by our SELF-GENERATING NAPHTHA WELSBACH BURNER, and thereby supply a uniform light in all localities.

Correspondence Solicited from Gas Companies and Others interested in Municipal and Outside Lighting.



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THE BIGGEST LITTLE LIGHT IN THE WORLD.

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Uses Two Feet of Gas per Hour.

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Completely Hidden from View.

Use your own globe--either gas or electric.

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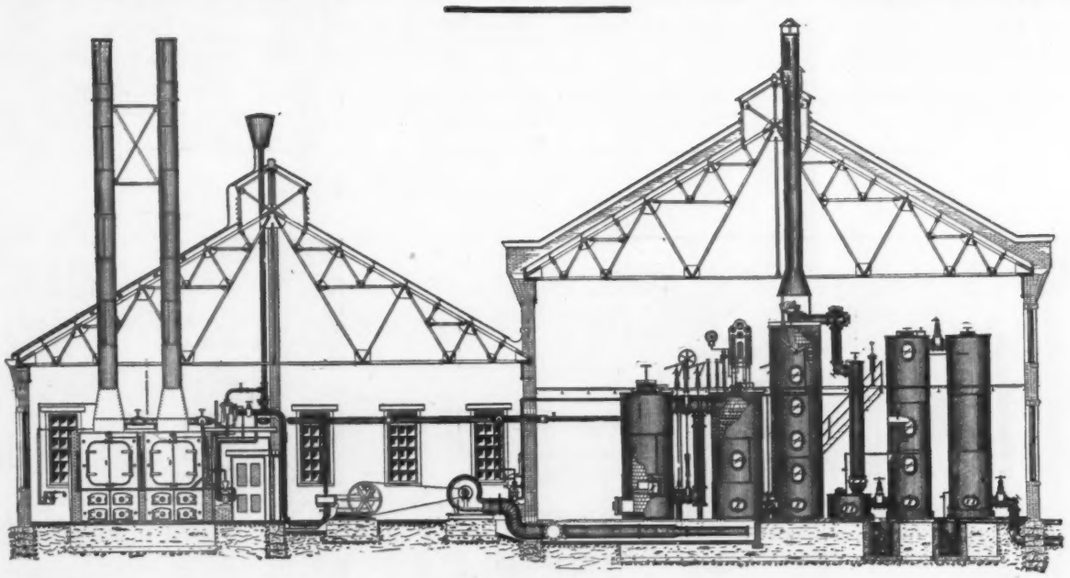

TOTAL SETS INSTALLED TO JULY 1, 1909, ... 704
TOTAL DAILY CAPACITY TO JULY 1, 1909, ... 577,440,000 cu. ft.

Tar Extractors for Carburetted Water Gas.
Photometrical Apparatus.
Gas Analysis Apparatus.
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Straight Standpipe Cleaners.
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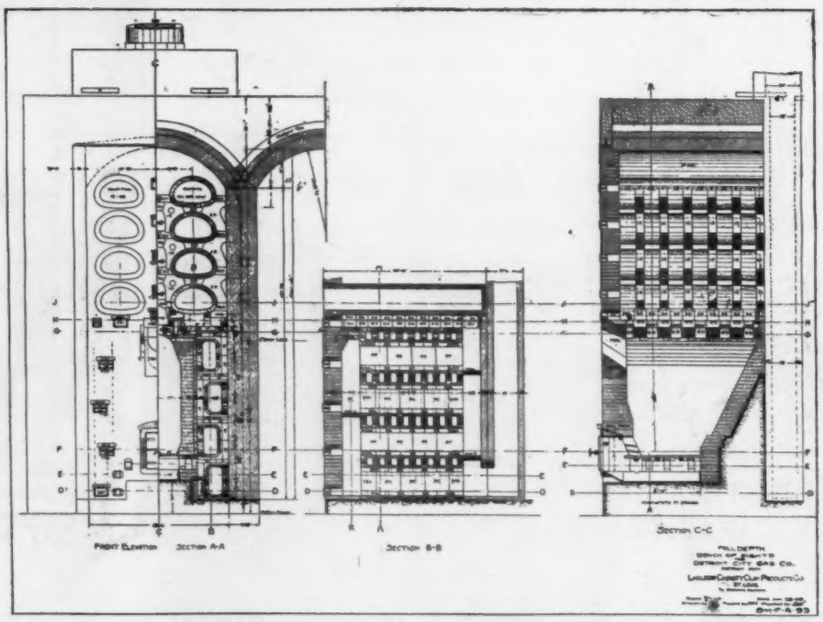

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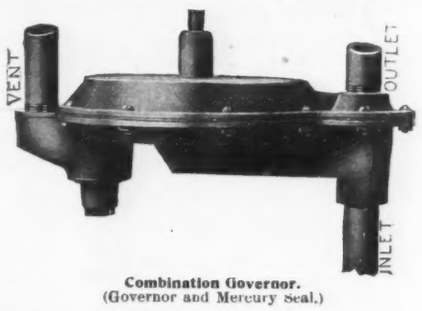

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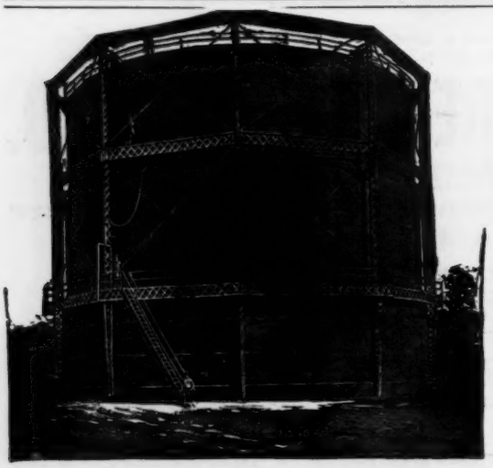

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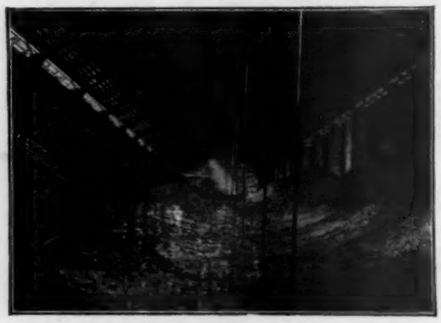

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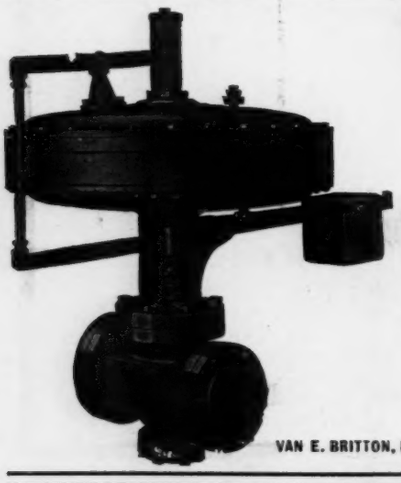

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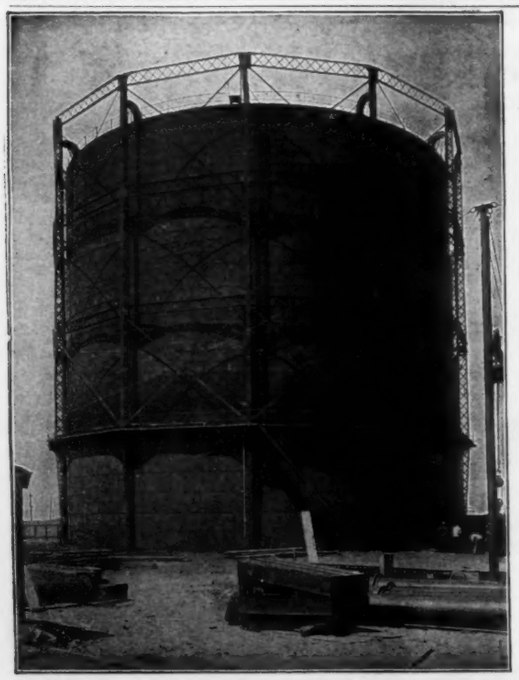

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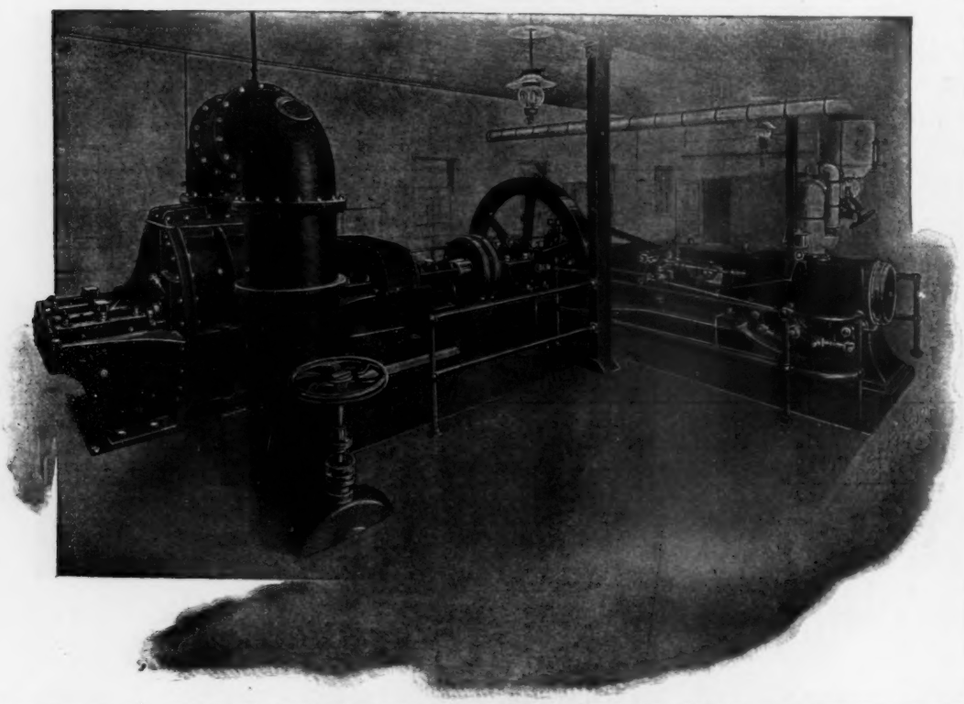

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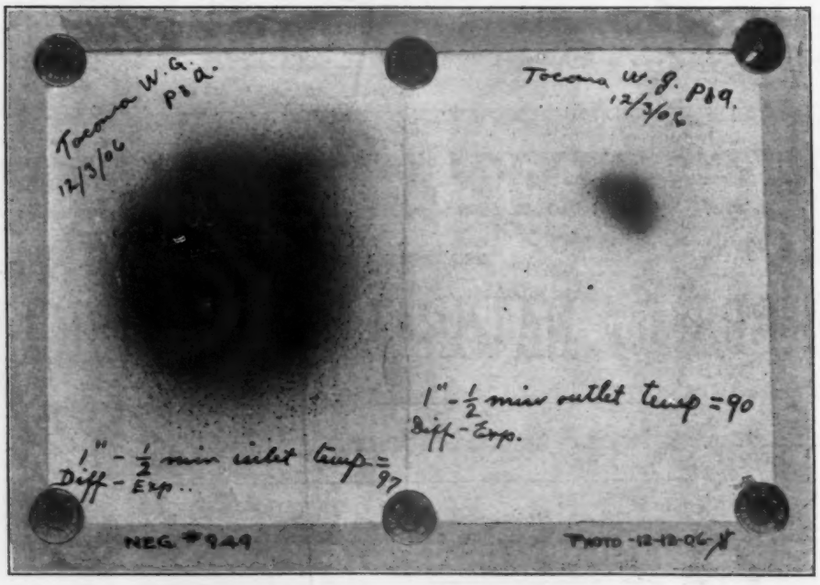

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